PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-107825

(43)Date of publication of application : 20.04.1999

(51)Int.Cl. F02D 41/12
F02D 41/12
F02M 69/32
F02D 41/32

(21)Application number : 09-269985

(22)Date of filing : 02.10.1997

(71)Applicant : NISSAN MOTOR CO LTD

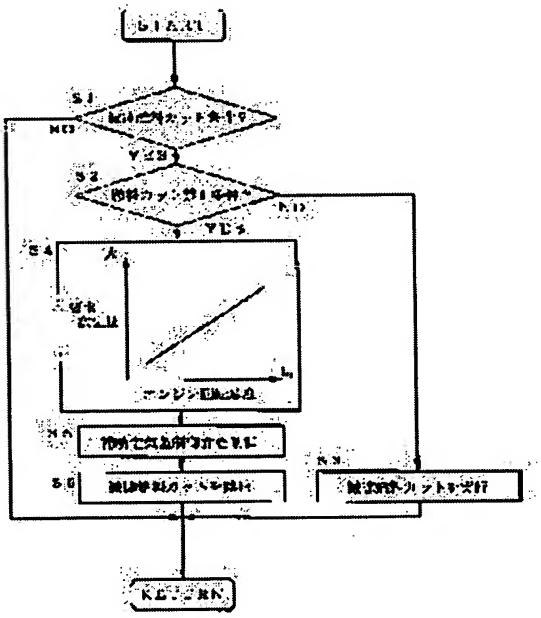
(72)Inventor : MORI KOICHI
SATO TATSUO

(54) AIR AMOUNT CONTROLLER FOR ENGINE

(57)Abstract:

PROBLEM TO BE SOLVED: To perform control so as to set a proper air amount without a misfire or acceleration when speed reduction fuel cut is prohibited because of a high catalyst temperature.

SOLUTION: Fuel cutting is performed during speed reduction running where a throttle valve is fully closed and an engine speed is equal to a specified speed or higher (S1), but when a catalyst temperature is equal to a specified value or higher, speed reduction fuel cutting is prohibited (S2). For prohibiting the speed reduction fuel cutting, an auxiliary air amount supplied to the engine by bypassing the throttle valve is controlled to a target boost according to an engine speed (S4, and S50).



LEGAL STATUS

[Date of request for examination] 27.09.2001

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the technique for controlling an engine inhalation air content appropriately in detail about an engine air content control device in the driven operational status of the engine with which a fuel cut is forbidden.
[0002]
[Description of the Prior Art] Although the moderation fuel cut which stops the fuel supply to an engine from the former in the moderation operational status which is engine driven operational status is known, if said moderation fuel cut is performed under the conditions that the temperature of the catalyst which performs exhaust air purification is high, since advance of catalyst de-activation will speed up, when whenever [catalyst temperature] is high, said moderation fuel cut is forbidden, and to supply a fuel and to burn it in usual, is desired.
[0003] However, at the time of moderation, in order to make it burn without generating a flame failure since a throttle valve becomes a close by-pass bulb completely and negative pressure becomes high, supply of the air through the bypass path which bypasses a throttle valve is required. As a control technique of the amount of supplementary airs at the time of this moderation, there were some which are indicated by JP,58-178847,A conventionally.
[0004] This thing is detecting a moderation condition based on throttle opening, and changing the drive time amount of a compensating air valve according to the clausilium rate and opening change width of face of a throttle valve, and also determining the fuel amount of supply based on the above-mentioned throttle information, and even if it is it at the moderation time, it tends to control to the optimal air-fuel ratio.
[0005]
[Problem(s) to be Solved by the Invention] By the way, if the air contents at the time of moderation run short, a flame failure will occur, and there is a problem of torque occurring an air content being superfluous and accelerating, and it is necessary to control it to the value which can prevent acceleration, the air content at the time of moderation avoiding a flame failure. However, with the configuration which determines the amount of supplementary airs only from the information on whenever [throttle valve-opening] like above-mentioned before, depending on the engine speed, a demand air content could not necessarily be supplied, but it became clear experimentally that a flame failure and acceleration might occur.
[0006] Moreover, it becomes impossible to have controlled with a precision sufficient to a demand air content by the allobar etc., and a flame failure and acceleration may have occurred by it. Furthermore, a demand air content is no longer acquired immediately after moderation shift according to the response delay of the amount control valve of supplementary airs. It aims at offering the air content control unit with which the combustion which this invention is made [combustion] in view of the above-mentioned trouble, and a demand air content can be supplied [combustion] with a sufficient precision at the time of moderation operation to which a fuel cut is forbidden (engine driven operational status), with generates neither a flame failure nor acceleration is obtained.

[0007] Moreover, it aims at enabling it to supply the air content needed at the time of moderation (driven operational status) with a sufficient response.

[0008]
[Means for Solving the Problem] Therefore, invention according to claim 1 was taken as the configuration to which the time when an engine speed is higher makes [many] the air content supplied to an engine in the driven operational status of the engine accompanied by combustion. in the driven operational status to which according to this configuration is usually resembled and supply of a fuel is carried out, without performing a fuel cut, the time when an engine speed is higher makes [many] the air content supplied to an engine, and it controls to a different demand air content for every engine speed, and controls to the target boost which does not produce a flame failure and acceleration.
[0009] In addition, in this application, engine driven operational status shall mean the condition which a throttle valve is made an abbreviation close by-pass bulb completely in the engine carried in the car while under moderation operation or a car runs a downward slope, and an engine drives in response to turning effort conversely from the driving wheel of a car that it is in the so-called engine brake condition, and an engine speed is more than a predetermined rotational speed.
[0010] An operational status detection means by which invention according to claim 2 detects engine operational status, When the driven operational status of the engine accompanied by combustion is detected by the air content control valve which controls the air content supplied to an engine, a rotational-speed detection means to detect an engine rotational speed, and said operational status detection means It is constituted including the air content control means which controls said air content control valve so that the air content by which the time when the rotational speed detected with said rotational-speed detection means is higher is supplied to an engine increases.
[0011] According to this configuration, in the driven operational status of the engine accompanied by combustion, the opening of an air content control valve is controlled so that an engine inhalation air content increases as the time when an engine speed is high. In addition, said air content control valve may be a throttle valve by which a closing motion drive is carried out with an actuator, and may be the amount control valve of supplementary airs infixed in the bypass path which bypasses a throttle valve and is prepared.
[0012] Invention according to claim 3 is constituted as shown in drawing 1 . In drawing 1 , an operational status detection means is a means to detect engine operational status, and a fuel cut means stops the fuel supply to an engine, when engine predetermined driven operational status is detected by this operational status detection means. Moreover, whenever [catalyst temperature], a detection means is a means to detect the temperature of the catalyst infixed in the engine flueway, and a fuel cut prohibition means forbids a halt of the fuel supply by said fuel cut means, when the temperature of the catalyst detected with a detection means whenever [this catalyst temperature] is beyond a predetermined value.
[0013] On the other hand, the amount control valve of supplementary airs is a valve which controls the amount of supplementary airs which is infixed in the bypass path which bypasses a throttle valve, and is supplied to an engine from this bypass path. Moreover, a rotational-speed detection means is a means to detect an engine rotational speed, and the time when the rotational speed detected with said rotational-speed detection means is higher sets up greatly the amount of target supplementary airs by which the amount setting means of target supplementary airs is supplied to an engine.
[0014] And the amount control means of supplementary airs controls said amount control valve of supplementary airs to become the amount of target supplementary airs to which an engine is said predetermined driven operational status, and the amount of supplementary airs supplied to an engine is set with said target-air-volume setting means when a halt of fuel supply is therefore forbidden to said fuel cut prohibition means. Although a fuel cut is fundamentally performed in engine driven operational status, when whenever [catalyst temperature] results in speeding up catalyst de-activation by the fuel cut highly according to this configuration, said fuel cut is forbidden and fuel supply is made to perform. And in the driven operational status accompanied by the combustion which forbade the fuel cut based on whenever [catalyst temperature], the time when an engine speed is higher makes [many] the amount of supplementary airs.
[0015] In invention according to claim 4, it considered as the configuration which infixes in said bypass path the cut valve which opens according to engine inhalation negative pressure when an engine is said predetermined driven operational status. According to this configuration, since supply

of the supplementary air through a bypass path will be performed and said cut valve will be opened [even if the amount control valve of supplementary airs is open] and closed according to inhalation negative pressure if the cut valve has closed, it can set up so that a bypass path may be opened only in the condition (condition small as absolute pressure which sets a vacuum to 0) that inhalation negative pressure to be supplied [of the supplementary air] is big.

[0016] In invention according to claim 5, said amount control means of supplementary airs considered opening of said amount control valve of supplementary airs as the configuration which controls beforehand to the target opening corresponding to said amount of target supplementary airs, when the temperature of the catalyst detected with the detection means whenever [said catalyst temperature] was said beyond predetermined value. When whenever [catalyst temperature] is in the elevated-temperature condition that prohibition of a fuel cut is performed according to this configuration, before being in driven operational status, corresponding to the driven operational status to which fuel supply is carried out beforehand, the opening of the amount control valve of supplementary airs is controlled, and when it actually shifts to driven operational status, a demand air content is immediately acquired by open control of said cut valve.

[0017] In invention according to claim 6, when the difference of the opening of said amount control valve of supplementary airs when engine operational status shifts to said predetermined driven operational status, and said target opening was beyond a predetermined value, it considered as the configuration which establishes the fuel cut compulsion means by the opening difference which priority is given [difference] over said fuel cut prohibition means, and stops the fuel supply to an engine compulsorily. According to this configuration, in the configuration which controls the opening of the amount control valve of supplementary airs beforehand, when it is the case where it shifts to driven operational status before reaching target opening, and the amount of demand supplementary airs is not obtained from the early stages of driven operational status, a fuel cut is made to perform and generating of the flame failure by the lack of an air content etc. is avoided beforehand.

[0018] In invention according to claim 7, it considered as the configuration which has priority over the condition of inhalation negative pressure, and holds said cut valve to a closed state in the open condition of a throttle valve. According to this configuration, when it is in the open condition of a throttle valve, a cut valve is held to close and the torque fluctuation by supply of the amount of supplementary airs in a run state is usually avoided. In invention according to claim 8, it had an inhalation negative pressure detection means to detect engine inhalation negative pressure as absolute pressure, and said amount setting means of target supplementary airs was considered as the configuration which sets up the amount of target supplementary airs according to the rotational speed and the inhalation negative pressure which were detected.

[0019] According to this configuration, while controlling the amount of supplementary airs based on an engine speed, change of an atmospheric pressure etc. amends a part to be uncontrollable by the amount of supplementary airs according to said rotational speed to expected inhalation negative pressure based on the detection result of actual inhalation negative pressure (absolute pressure). In invention according to claim 9, it had a flame-failure detection means to detect an engine flame failure, and said amount setting means of target supplementary airs was considered as the detected rotational speed and the configuration which sets up the amount of target supplementary airs according to the existence of a flame failure.

[0020] If the amount of supplementary airs is insufficient according to this configuration and a flame failure occurs, it is possible to make the increase correction of the amount of supplementary airs according to an engine speed based on this flame-failure generating. In invention according to claim 10, when the amount of supplementary airs controlled by said amount control means of supplementary airs crossed the predetermined range, it considered as the configuration which establishes the fuel cut compulsion means by the amount of supplementary airs which priority is given [amount] over said fuel cut prohibition means, and stops the fuel supply to an engine compulsorily.

[0021] When the amount of supplementary airs (indicated value) crosses the range usually demanded according to this configuration, it is in a condition uncontrollable by components failure etc. to a target air content, and what a flame failure and acceleration may produce is presumed and generating

of a flame failure and acceleration is prevented by performing a fuel cut. In invention according to claim 11, it considered as the configuration which establishes a fuel cut compulsion means at the time of the acceleration which priority is given [acceleration] over said fuel cut prohibition means, and stops the fuel supply to an engine compulsorily when acceleration operational status is detected by said operational status detection means during control of the amount of supplementary airs by said amount control means of supplementary airs.

[0022] According to this configuration, when it accelerates during control of the amount of supplementary airs, it is judged as that to which more amounts of supplementary airs than the amount required are supplied, and the dissolution of an acceleration condition is aimed at by performing a fuel cut.

[0023]

[Effect of the Invention] According to invention according to claim 1 or 2, the air content in driven operational status can be controlled in a proper amount for every engine speed, and there is effectiveness of the ability to make it burn, without causing a flame failure and acceleration. While being able to control the catalyst de-activation by the fuel cut, when a fuel cut is forbidden that catalyst de-activation should be controlled according to invention according to claim 3, it is effective in being controllable to a flame failure and the air content which does not cause acceleration.

[0024] According to invention according to claim 4, it is effective in supply of the amount of supplementary airs in the condition that there is no need being avoidable. According to invention according to claim 5, it can control to the opening of which the opening of the amount control valve of supplementary airs is required in advance at the time of moderation, with is effective in the responsibility of air content control being improvable.

[0025] According to invention according to claim 6, it is effective in it being avoidable to shift to the driven operational status accompanied by combustion with the condition that the opening of the amount control valve of supplementary airs has not reached even target opening. According to invention according to claim 7, when the throttle valve is opened, it is effective in the ability to prevent certainly in torque fluctuation arising by supply of the unnecessary amount of supplementary airs.

[0026] According to invention according to claim 8, even if there is change of an atmospheric pressure etc., it is effective in being controllable with a precision sufficient to target inhalation negative pressure (air content). According to invention according to claim 9, it is effective in the ability to prevent certainly generating of the flame failure by the lack of an air content. According to invention according to claim 10, it is effective in the combustion accompanied by a flame failure and acceleration being avoidable by judging the condition that it is uncontrollable by components failure etc. to a demand air content, and performing a fuel cut.

[0027] According to invention according to claim 11, it is effective in the ability to prevent generating of the acceleration by the overair content certainly.

[0028]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained. Drawing 2 is drawing showing the system configuration of the engine in the gestalt of the 1st operation, and the air filtered with the air cleaner 2 is measured by the throttle valve 3, and it is attracted by the engine 1 in a cylinder through an inlet valve 4.

[0029] The electromagnetic fuel injection valve 5 which injects a direct fuel (gasoline) in each gas column of an engine 1 at a combustion chamber is formed in each, and gaseous mixture is formed in a cylinder with the fuel injected from this fuel injection valve 5. The gaseous mixture in a cylinder carries out ignition combustion by jump spark ignition by the ignition plug 6, and combustion exhaust air is discharged through an exhaust valve 7, is purified with a catalyst 8, and is emitted into atmospheric air.

[0030] Although the engine 1 in the gestalt of this operation constitutes a direct injection type jump-spark-ignition engine by the above-mentioned configuration, it may be a port injection type jump-spark-ignition engine with which a fuel injection valve 5 injects a fuel into a suction-port part. The control unit 10 which built in the microcomputer controls by data processing based on the detecting signal from various sensors the ignition (energization to the ignition coil which is not illustrated) by the fuel injection by said fuel injection valve 5, and the ignition plug 6.

[0031] the air flow meter 11 which detects an intake air flow Q as said various sensors, the position sensor 12 which outputs the position signal POS for every 1-degreeCA, the reference sensor 13 which outputs the reference signal (criteria include-angle signal) REF for whenever [criteria crank angle / every], and combustion -- the coolant-temperature-sensor 17 grade which detects the air-fuel ratio sensor 15 which detects the air-fuel ratio of gaseous mixture, the throttle sensor 16 which detects the opening TVO of said throttle valve 3, and a circulating water temperature Tw is prepared.

[0032] In addition, based on said position signal POS or the reference signal REF, a control unit 10 computes an engine speed Ne, and a function is realized by said position sensor 12 or the reference sensor 13, and the control unit 10 as a rotational-speed detection means. furthermore -- while bypassing a throttle valve 3 and forming the bypass path 21 -- this bypass path 21 -- actuators, such as a step motor, -- opening -- the amount control valve 22 (air content control valve) of supplementary airs by which a closing motion drive is carried out controllable is infixed, and a control unit 10 controls the amount of supplementary airs supplied to an engine through said bypass path 21 by controlling the opening of said amount control valve 22 of supplementary airs.
[0033] While said control unit 10 calculates the basic fuel oil consumption Tp based on the engine speed Ne computed based on the intake air flow Q detected with an air flow meter 11 and the position signal POS, or the reference signal REF, it amends this basic fuel oil consumption Tp based on the air-fuel ratio detected by the circulating water temperature Tw or the air-fuel ratio sensor 15, and calculates the final fuel oil consumption Ti. And the fuel supply to an engine 1 is controlled by outputting the injection pulse signal of the pulse width which is equivalent to said fuel oil consumption Ti in predetermined injection timing to said fuel injection valve 5.
[0034] Moreover, a throttle valve 3 is a close by-pass bulb completely, and an engine speed Ne performs control (henceforth a moderation fuel cut) made to suspend the fuel injection by said fuel injection valve 5 at the time of moderation operation more than a predetermined rate (predetermined driven operational status), and a control unit 10 aims at the control and the improvement in fuel consumption in HC discharge (fuel cut means). However, since a catalyst 8 is made to deteriorate when a fuel cut is performed in the condition that the temperature of a catalyst 8 is high, when the temperature of a catalyst 8 is beyond predetermined temperature, a moderation fuel cut is forbidden (fuel cut prohibition means).
[0035] And in the condition that a moderation fuel cut is forbidden, as a control unit 10 is shown in the flow chart of drawing 3 , it controls said amount control valve 22 of supplementary airs, and it is controlling the air content at the time of moderation operation accompanied by combustion. It sets to the flow chart of drawing 3 , and is step 1 (all over drawing, it is described as S1.). It distinguishes whether in it being the same as that of the following, they are moderation fuel cut conditions.
[0036] And if it is moderation fuel cut conditions, it will progress to step 2 and will distinguish whether they are the conditions which should forbid a moderation fuel cut based on the temperature of a catalyst 8. You may be the configuration which may detect the temperature of a catalyst 8 with a direct temperature sensor, and is presumed from an engine load, an engine speed Ne, etc. (whenever [catalyst temperature] detection means).
[0037] At the time of the conditions on which whenever [catalyst temperature] can perform a moderation fuel cut low, it progresses to step 3 and a moderation fuel cut is performed. on the other hand, when whenever [catalyst temperature] is high and a moderation fuel cut is forbidden, it will usually be alike and fuel injection will be performed, but since negative pressure may become high, an air content may be insufficient and a flame failure may arise when a throttle valve 3 is closed by the close by-pass bulb completely, an air content is controlled by said amount control valve 22 of supplementary airs.
[0038] It progresses to step 4 and, specifically, the amount of target supplementary airs corresponding to the engine speed Ne at that time is searched with reference to the table which makes the amount of target supplementary airs have memorized beforehand corresponding to an engine speed Ne (the amount setting means of target supplementary airs). The time when an engine speed Ne is higher is set as the big value, and said amount of target supplementary airs can be controlled by this in the proper amount of supplementary airs corresponding to the difference in the demand air content which changes with engine speeds Ne. That is, as shown in drawing 4 , as a

result of being beforehand set up as a value from which the target boost (absolute pressure) between a boost of a flame-failure limitation and a boost equivalent to N/L (no load) is obtained, the time when an engine speed Ne is higher is set as a big value, and thereby, it is controllable to the air content which an engine does not accelerate, the amount of target supplementary airs according to said engine speed Ne avoiding generating of a flame failure.

[0039] The part of the above-mentioned steps 1 and 2 is equivalent to an operational status detection means to detect moderation operation (driven operation) accompanied by combustion. The opening of said amount control valve 22 of supplementary airs is controlled by step 5 to the opening from which the amount of target supplementary airs set up at said step 4 is obtained (an air content control means, the amount control means of supplementary airs).

[0040] A fuel cut is forbidden in response to the distinction result in said step 2 (fuel cut prohibition means), and it is made to burn in step 6 in the condition that the amount of supplementary airs is obtained through said amount control valve 22 of supplementary airs. Drawing 5 is the system configuration Fig. of the engine in which the gestalt of the 2nd operation is shown, and only points equipped with the boost sensor 18 (inhalation negative pressure detection means) which detects a boost (inhalation negative pressure) of an engine 1 as absolute pressure which sets a vacuum to 0 differ to drawing 2 . In addition, a boost shall be hereafter shown by absolute pressure.

[0041] And as it is shown in the flow chart of drawing 6 , in the moderation operational status to which a fuel cut is forbidden, the amount control valve 22 of supplementary airs is controlled by the gestalt of the 2nd operation. In the flow chart of drawing 6 , at step 11, when it distinguishes whether they are the conditions of a moderation fuel cut and conditions are satisfied, it distinguishes whether it is in the condition that a moderation fuel cut should be forbidden at step 12 based on the temperature of a catalyst 8.

[0042] And when the temperature of a catalyst 8 is low, it progresses to step 13 and a moderation fuel cut is performed. On the other hand, when the temperature of a catalyst 8 is the conditions which should forbid a moderation fuel cut highly, it progresses to step 14 and the amount of target supplementary airs is set up like said step 4 based on an engine speed Ne (the amount setting means of target supplementary airs).

[0043] At step 15, the boost PB (absolute pressure which sets a vacuum to 0) detected by said boost sensor 18 is read. At step 16, deflection deltaPB of the target boost PBTG and said detected actual boost PB is calculated in a setup of the amount of target supplementary airs based on said engine speed Ne (deltaPB=PBTG-PB).

[0044] At step 17, the amendment air content HOS corresponding to deflection deltaPB calculated at said step 16 is calculated with reference to the table which memorized the amendment air content HOS according to said deflection deltaPB beforehand. The table of the amendment air content HOS in the above-mentioned step 17 The absolute value of the amount HOS of amendments also becomes large, so that the absolute value of said deflection deltaPB is large. Said deflection deltaPB is forward. Moreover, when the actual boost PB is lower than the target boost PBTG, (when the actual boost is more closer to a vacuum) A forward value is set up as an amount HOS of amendments, and increase amendment of the amount of target supplementary airs is carried out. On the contrary, said deflection deltaPB is negative, when the actual boost PB is higher than the target boost PBTG, a negative value is set up as an amount HOS of amendments (when the target boost is more closer to a vacuum), and reduction amendment of the amount of target supplementary airs is carried out. Namely, by amending the amount of target supplementary airs with said amount HOS of amendments, even if there is change of an atmospheric pressure etc., the amount of supplementary airs which can obtain the target boost PBTG can be set up with a sufficient precision.

[0045] If the amount HOS of amendments is set up at step 17, at step 18, said amount HOS of amendments will be added and corrected to the amount of target supplementary airs set up at said step 14, and the opening of said amount control valve 22 of supplementary airs will be controlled by step 19 based on said corrected amount of target supplementary airs. And a moderation fuel cut is forbidden and it is made to burn in step 20 in the condition that the amount of supplementary airs is obtained as a result of the opening control by the above-mentioned step 19.

[0046] The flow chart of drawing 7 shows the situation of the amount control of supplementary airs in the gestalt of the 3rd operation. In addition, the contents of control in the gestalt of this 3rd

operation are explained below as what is applied to the system configuration in the gestalt of the 1st operation shown in drawing 2 . In the flow chart of drawing 7 , at step 31, moderation fuel cut conditions are distinguished, and it progresses to step 32 at the time of condition formation, and distinguishes whether it is in the condition that a fuel cut should be forbidden based on whenever [catalyst temperature].

[0047] And when whenever [catalyst temperature] can perform a moderation fuel cut low, it progresses to step 33 and a moderation fuel cut is performed. On the other hand, when whenever [catalyst temperature] are the conditions which should forbid a moderation fuel cut highly, it progresses to step 34 and the amount of target supplementary airs is set up like said steps 4 and 14 according to an engine speed Ne.

[0048] At step 35, it distinguishes whether the flame failure has occurred in an engine 1. Detection of a flame failure is detectable based on the cylinder internal pressure detected by this sensor, if it is the case where can detect based on fluctuation of an engine speed Ne, and it has a cylinder internal pressure sensor (flame-failure detection means). When the flame failure had occurred at step 35 and it was distinguished, and it progresses to step 36, only the predetermined value deltaalpha1 increases the amendment air content HOS, the flame failure had not occurred and it is distinguished, it progresses to step 37 and only the predetermined value deltaalpha2 (<deltaalpha1) decreases said amendment air content HOS. That is, when the flame failure has occurred, while judging the lack of an air content and increasing the amount of supplementary airs, when the flame failure has not occurred, the amount of supplementary airs is decreased that the acceleration by the overage of air should be avoided.

[0049] At step 38, the amount of target supplementary airs set up at said step 34 with said amount HOS of amendments is amended. At step 39, the bound value of the amount of supplementary airs is set up based on an engine speed Ne. Said bound value is set up corresponding to a boost of the no load and the flame-failure limitation which were shown in said drawing 4 .

[0050] At step 40, the amount of target supplementary airs obtained by amendment setup by the amount HOS of amendments at said step 38 distinguishes whether it is within the limits inserted with the bound value set up at said step 39. When the amount of target supplementary airs is judged to be within the limits inserted with a bound value at step 40, it progresses to step 41, the amount control valve 22 of supplementary airs is controlled according to said amount of target supplementary airs, and processing which forbids a moderation fuel cut is performed at step 42.

[0051] On the other hand, when the amount of target supplementary airs is judged to have crossed the range across which it faces with a bound value at step 40, it progresses to step 43 and a moderation fuel cut is performed (fuel cut compulsion means by the amount of supplementary airs). When the amount of target supplementary airs is over the bound value, the amount of target supplementary airs may not be obtained in fact by failure of the amount control valve 22 of supplementary airs, but combustion may be performed in the condition which a flame failure generates, or the condition of accelerating.

[0052] When unburnt [HC] may burn with a catalyst 8, the erosion of a catalyst 8 may be generated, if a flame failure occurs, and acceleration arises, operability will be spoiled greatly, and these are the matters which should cope with it more preferentially than advance of the catalyst de-activation by activation of a moderation fuel cut. Then, a moderation fuel cut is performed and moderation operation in the condition that a flame failure and acceleration arise at least is avoided.

[0053] In addition, even if it is at the time when whenever [catalyst temperature] is high until an ignition switch is turned off after that, when the amount of target supplementary airs is judged to have crossed the range across which it faces with a bound value at step 40, it will be good for a moderation fuel cut to be made not to be forbidden. The flow chart of drawing 8 shows the situation of the amount control of supplementary airs in the gestalt of the 4th operation. In addition, the contents of control in the gestalt of this 4th operation are explained below as what is applied to the system configuration in the gestalt of the 1st operation shown in drawing 2 .

[0054] In the flow chart of drawing 8 , at step 51, moderation fuel cut conditions are distinguished, and it progresses to step 52 at the time of condition formation, and distinguishes whether it is in the condition that a fuel cut should be forbidden based on whenever [catalyst temperature]. And when whenever [catalyst temperature] can perform a moderation fuel cut low, it progresses to step 53 and

a moderation fuel cut is performed.
[0055] On the other hand, when whenever [catalyst temperature] are the conditions which should forbid a moderation fuel cut highly, it progresses to step 54 and the amount of target supplementary airs is set up like said steps 4, 14, and 34 according to an engine speed Ne. At step 55, change deltaVSP (deltaVSP= newest vehicle speed-last time vehicle speed) of the vehicle speed is beyond a predetermined value, and it distinguishes whether the vehicle speed VSP shows increase change.
[0056] And although it will be under the condition which should forbid a moderation fuel cut while the car is accelerating if it puts in another way while the vehicle speed VSP is carrying out increase change, that acceleration of a moderation demand should be avoided certainly, it progresses to step 53 and a moderation fuel cut is performed. On the other hand, if it is judged that the vehicle speed VSP is not increasing, it progresses to step 56, and change deltaNe (deltaNe= newest rate-last time rate) of an engine speed Ne will be beyond a predetermined value, and it will distinguish whether the engine speed Ne shows increase change.
[0057] And also while the engine speed Ne is carrying out increase change, it progresses to step 53 and a moderation fuel cut is performed. The processing which progresses to step 53 is equivalent to a fuel cut compulsion means from above-mentioned step 55 or above-mentioned step 56 at the time of acceleration. When neither the vehicle speed VSP nor the engine speed Ne has carried out increase change, it progresses to step 57 and distinguishes whether the basic fuel oil consumption Tp is more than the minimum value. Said minimum value is equivalent to the minimum injection time when the injection quantity proportional to injection time is obtained. Since the Air Fuel Ratio Control nature may fall and a flame failure etc. may occur when the basic fuel oil consumption Tp is less than the minimum value, it progresses to step 53 and a moderation fuel cut is performed.
[0058] Neither the vehicle speed VSP nor the engine speed Ne is carrying out increase change, and when the basic fuel oil consumption Tp is more than the minimum value, it progresses to step 58 and the amount control valve 22 of supplementary airs is controlled according to the amount of target supplementary airs, and a moderation fuel cut is forbidden at step 59. In addition, although considered as the configuration which determines the amount of target supplementary airs only based on an engine speed Ne with the gestalt of implementation of the above 4th the configuration which determines the amount of target supplementary airs like the gestalt of the 2nd operation based on the detection result of an engine speed Ne and the boost sensor 18 -- or Like the gestalt of the 3rd operation, it is good also as a configuration which performs a moderation fuel cut like the above based on change of the vehicle speed VSP and an engine speed Ne, and the basic fuel oil consumption Tp in the configuration which determines the amount of target supplementary airs from the result of an engine speed Ne and flame-failure detection.
[0059] Drawing 9 is the system chart of the engine in which the gestalt of the 5th operation is shown, and can be applied to the system configuration which shows the amount control of supplementary airs shown in said gestalt of the 1st - the 4th operation to said drawing 9 . In drawing 9 , the cut valve 23 by which a closing motion drive is carried out in turning on and off is infixed in the bypass path 21 of the amount control valve of supplementary airs 22 downstream, as shown in drawing 10, this cut valve 23 is processing in the logical circuit which established the signal of the boost sensor 18 in the control unit 10, and closing motion (un-energizing [energization and]) control is carried out based on the output of this logical circuit. That is, it is controlled by either of an open condition and a closed state based on the boost detected by the boost sensor 18, and in order to raise the dependability of control, it is made to be controlled not by software processing but by the logical circuit.
[0060] Supply of the amount of supplementary airs opened immediately after open control was carried out, it was controlled by the condition exceed said criteria boost by close and this shifted to moderation operation, when it became below the criteria boost that said cut valve 23 is below the boost of no-load N/L shown in drawing 4 (absolute pressure), and was set up more than the target boost at the time of moderation, and minded the bypass path 21 is closed if .
[0061] According to this configuration, even if there is open failure of the amount control valve 22 of supplementary airs, it is except the time of moderation and can avoid that the amount of supplementary airs will be supplied. The flow chart of drawing 11 shows the gestalt of the 6th operation, and shows the amount control of supplementary airs applied to the system configuration

of said drawing 9 . In the flow chart of this drawing 11, the temperature of a catalyst 8 distinguishes whether it is in the predetermined elevated-temperature condition that a moderation fuel cut should be forbidden at step 61. And when whenever [catalyst temperature] is an elevated temperature, it progresses to step 62, and since it corresponds at the time of moderation operation to which a fuel cut is forbidden, without waiting for moderation operation, the amount of target supplementary airs is set up according to an engine speed like the gestalt of the 1st operation, and the opening of the amount control valve 22 of supplementary airs is opened to an equivalent for said amount of target supplementary airs at step 63.

[0062] At step 64, moderation fuel cut conditions are distinguished, and it progresses to step 65 at the time of condition formation, and distinguishes whether it is in the condition that a fuel cut should be forbidden based on whenever [catalyst temperature]. And when whenever [catalyst temperature] can perform a moderation fuel cut low, it progresses to step 66 and a moderation fuel cut is performed.

[0063] On the other hand, when whenever [catalyst temperature] are the conditions which should forbid a moderation fuel cut highly, it progresses to step 67 and a moderation fuel cut is forbidden. Since open control of the cut valve 23 is carried out with the fall of the boost by the shift to moderation operation at this time, the amount of supplementary airs adjusted by the amount control valve 22 of supplementary airs currently opened beforehand is immediately supplied to an engine.

[0064] By controlling, after shifting to moderation operation, the opening of the amount control valve 22 of supplementary airs Although the amount of target supplementary airs cannot be immediately obtained according to the response delay of opening change When it is predicted that a moderation fuel cut is performed as mentioned above, the opening of the amount control valve 22 of supplementary airs is beforehand opened to the opening corresponding to the amount of target supplementary airs. If the cut valve 23 is opened with the shift to moderation operation while intercepting supply of the amount of supplementary airs by the cut valve 23 before moderation operation is actually carried out Since the response of the cut valve 23 opened and closed in turning on and off is good, it is possible to make the amount of target supplementary airs supply from from immediately after shifting to moderation operation.

[0065] After actually shifting to moderation operation, the amount of target supplementary airs In addition, the detection result of the boost sensor 18, Correct based on the detection result of a flame failure, and when the corrected this amount of target supplementary airs crosses the predetermined range, carry out fuel KAHHETO shift, or When acceleration is detected, it is also possible to consider as the configuration made to shift to a fuel cut, and this is the same also in the gestalt of the 7th and the 8th operation mentioned later.

[0066] The flow chart of drawing 12 shows the gestalt of the 7th operation, and shows the amount control of supplementary airs applied to the system configuration of said drawing 9 . It progresses to step 72, when whenever [catalyst temperature] is an elevated temperature, in the flow chart of this drawing 12, it distinguishes whether the temperature of a catalyst 8 is in the predetermined elevated-temperature condition that a moderation fuel cut should be forbidden at step 71, since it corresponds at the time of moderation operation to which a fuel cut is forbidden, the amount of target supplementary airs is set up, without waiting for moderation operation, and at step 73, the opening of the amount control valve 22 of supplementary airs is opened to an equivalent for said amount of target supplementary airs.

[0067] At step 74, a throttle valve 3 distinguishes whether it is a close by-pass bulb completely. And when it is in the condition that the throttle valve 3 is opened, it progresses to step 75, priority is given over closing motion control of the cut valve 23 according to the boost detected by the boost sensor 18, and the cut valve 23 is controlled to close. It avoids that the amount of supplementary airs is supplied to an engine 1 through the amount control valve 22 of supplementary airs by this in the run state by which the throttle valve 3 was opened. Namely, although the amount control valve 22 of supplementary airs is beforehand opened in the opening corresponding to the demand at the time of moderation as mentioned above with the gestalt of this operation before moderation operation is carried out Since torque fluctuation will arise and sense of incongruity will be given to an operator in the run state according to which the throttle 3 is opened if the supplementary air is supplied That this should be avoided certainly, when the throttle valve 3 is open, it is not concerned with the boost at

that time, but the cut valve 23 is closed.
[0068] On the other hand, when a throttle valve 3 is a close by-pass bulb completely, it progresses to step 76, moderation fuel cut conditions other than throttle-valve 3 close by-pass bulb completely are distinguished, and it progresses to step 77 at the time of condition formation, and distinguishes whether it is in the condition that a fuel cut should be forbidden based on whenever [catalyst temperature]. And when whenever [catalyst temperature] can perform a moderation fuel cut low, it progresses to step 78 and a moderation fuel cut is performed.
[0069] On the other hand, when whenever [catalyst temperature] are the conditions which should forbid a moderation fuel cut highly, it progresses to step 79 and a moderation fuel cut is forbidden. At this time, open control of the cut valve 18 is carried out with the fall of the boost by the shift to moderation operation. The flow chart of drawing 13 shows the gestalt of the 8th operation, and shows the amount control of supplementary airs applied to the system configuration of said drawing 9 .
[0070] It progresses to step 82, when whenever [catalyst temperature] is an elevated temperature, in the flow chart of this drawing 13, it distinguishes whether the temperature of a catalyst 8 is in the predetermined elevated-temperature condition that a moderation fuel cut should be forbidden at step 81, since it corresponds at the time of moderation operation to which a fuel cut is forbidden, the amount of target supplementary airs is set up, without waiting for moderation operation, and at step 84, the opening of the amount control valve 22 of supplementary airs is opened to an equivalent for said amount of target supplementary airs.
[0071] At step 84, a throttle valve 3 distinguishes whether it is a close by-pass bulb completely. And when it is in the condition that the throttle valve 3 is opened, it progresses to step 85, priority is given over closing motion control of the cut valve 23 according to the boost detected by the boost sensor 18, and the cut valve 23 is controlled to close. On the other hand, when a throttle valve 3 is a close by-pass bulb completely, it progresses to step 86, moderation fuel cut conditions other than throttle-valve 3 close by-pass bulb completely are distinguished, and it progresses to step 87 at the time of condition formation, and distinguishes whether it is in the condition that a fuel cut should be forbidden based on whenever [catalyst temperature].
[0072] And when whenever [catalyst temperature] can perform a moderation fuel cut low, it progresses to step 88 and a moderation fuel cut is performed. On the other hand, when whenever [catalyst temperature] are the conditions which should forbid a moderation fuel cut highly, it progresses to step 89 and distinguishes whether it is the no whose deflection (deflection = real opening-target opening) of the opening of the amount control valve 22 of supplementary airs and target opening is predetermined within the limits.
[0073] Specifically, said deflection - It is smaller than D1 and real opening distinguishes whether it is small from target opening to one or more predetermined values D. Said D1 is judged to be a thing with the possibility of a flame failure with the lack of an air content, when it is a value equivalent to the deflection of the target boost corresponding to target opening, and a boost of a flame-failure limitation, and real opening is smaller than target opening and the deflection is one or more predetermined values D.
[0074] Moreover, it distinguishes whether said deflection is larger than D2, and real opening is larger than target opening to two or more predetermined values D. Said D1 is judged to be what may be accelerated by the overair content, when it is a value equivalent to the deflection of the target boost corresponding to target opening, and a boost of no load N/L, and real opening is larger than target opening and the deflection is two or more predetermined values D.
[0075] Although it progresses to step 88 and whenever [catalyst temperature] are high conditions since a flame failure or acceleration may arise by the excess and deficiency of an air content even if it forbids a moderation fuel cut when real opening is smaller than target opening to one or more predetermined values D, or when real opening is larger than target opening to two or more predetermined values D, a moderation fuel cut is performed (fuel cut compulsion means by the opening difference).
[0076] on the other hand -- target opening-predetermined -- since the excess and deficiency of an air content which causes a flame failure and acceleration are not produced when it is the value D1 <= real opening <= target opening + predetermined value D2, it progresses to step 90 and a moderation

fuel cut is forbidden. Just before moderation fuel cut conditions were satisfied, it was judged that whenever [catalyst temperature] was high, according to this configuration, tended to control the opening of the amount control valve 22 of supplementary airs to the opening which balanced the amount of target supplementary airs beforehand, but Even before starting moderation operation, cannot make even target opening control, but when ** is also the comparatively large value of extent to which the deflection of the target opening at that time and real opening invites a flame failure and acceleration Since there are a flame failure and possibility of acceleration in an initial state even if it forbids a moderation fuel cut, a moderation fuel cut is performed as it is, and generating of a flame failure and acceleration is prevented beforehand.

[0077] In addition, opening can be equipped with the throttle valve controlled electrically, and can apply this invention also to an engine without the path which bypasses this. Namely, although whenever [throttle valve-opening] is controlled by the situation (the amount of accelerator treading in by the operator is the condition of 0) that an engine output is not required by the abbreviation close by-pass bulb completely, also in such an engine, and a fuel cut will be performed if the engine speed at this time is more than predetermined rotational speed Under the present circumstances, when both fuel cut conditions and the fuel cut prohibition conditions by whenever [catalyst temperature] are satisfied, only the minute opening set up according to an engine speed should carry out increase amendment of whenever [throttle valve-opening].

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The air content control unit of the engine characterized by the time when an engine speed is higher making [many] the air content supplied to an engine in the driven operational status of the engine accompanied by combustion.
[Claim 2] An operational status detection means to detect engine operational status, and the air content control valve which controls the air content supplied to an engine, When the driven operational status of the engine accompanied by combustion is detected by a rotational-speed detection means to detect an engine rotational speed, and said operational status detection means The air content control unit of the engine characterized by being constituted including the air content control means which controls said air content control valve so that the air content by which the time when the rotational speed detected with said rotational-speed detection means is higher is supplied to an engine increases.
[Claim 3] When engine predetermined driven operational status is detected by an operational status detection means to detect engine operational status, and this operational status detection means Whenever [catalyst temperature / which detects the temperature of the catalyst infixed in a fuel cut means to stop the fuel supply to an engine, and the engine flueway], when a detection means and the temperature of the catalyst detected with a detection means whenever [this catalyst temperature] are beyond predetermined values A fuel cut prohibition means to forbid a halt of the fuel supply by said fuel cut means, The amount control valve of supplementary airs which controls the amount of supplementary airs which is infixed in the bypass path which bypasses a throttle valve, and is supplied to an engine from this bypass path, A rotational-speed detection means to detect an engine rotational speed, and an amount setting means of target supplementary airs by which the time when the rotational speed detected with said rotational-speed detection means is higher sets up greatly the amount of target supplementary airs supplied to an engine, When an engine is said predetermined driven operational status and a halt of fuel supply is therefore forbidden to said fuel cut prohibition means The air content control unit of the engine characterized by being constituted including the amount control means of supplementary airs which controls said amount control valve of supplementary airs so that the amount of supplementary airs supplied to an engine turns into the amount of target supplementary airs set up with said target-air-volume setting means.
[Claim 4] The air content control unit of the engine according to claim 3 characterized by infixing in said bypass path the cut valve which opens according to engine inhalation negative pressure when an engine is said predetermined driven operational status.
[Claim 5] Said amount control means of supplementary airs is the air content control unit of the engine according to claim 4 characterized by controlling beforehand the opening of said amount control valve of supplementary airs to the target opening corresponding to said amount of target supplementary airs when the temperature of the catalyst detected with the detection means whenever [said catalyst temperature] is said beyond predetermined value.
[Claim 6] The air content control unit of the engine according to claim 5 characterized by establishing the fuel cut compulsion means by the opening difference which priority is given [difference] over said fuel cut prohibition means, and stops the fuel supply to an engine compulsorily when the difference of the opening of said amount control valve of supplementary airs when engine operational status shifts to said predetermined driven operational status, and said target

opening is beyond a predetermined value.
[Claim 7] The air content control unit of the engine of any one publication of claim 4-6 characterized by giving priority over the condition of inhalation negative pressure, and holding said cut valve to a closed state in the open condition of a throttle valve.
[Claim 8] It is the air content control unit of the engine of any one publication of claim 3-7 which is equipped with an inhalation negative pressure detection means to detect engine inhalation negative pressure as absolute pressure, and is characterized by said amount setting means of target supplementary airs setting up the amount of target supplementary airs according to the rotational speed and the inhalation negative pressure which were detected.
[Claim 9] It is the air content control unit of the engine of any one publication of claim 3-8 which is equipped with a flame-failure detection means to detect an engine flame failure, and is characterized by said amount setting means of target supplementary airs setting up the amount of target supplementary airs according to the existence of the detected rotational speed and a flame failure.
[Claim 10] The air content control unit of the engine of any one publication of claim 3-9 characterized by establishing the fuel cut compulsion means by the amount of supplementary airs which priority is given [amount] over said fuel cut prohibition means, and stops the fuel supply to an engine compulsorily when the amount of supplementary airs controlled by said amount control means of supplementary airs crosses the predetermined range.
[Claim 11] The air content control unit of the engine of any one publication of claim 3-11 characterized by establishing a fuel cut compulsion means at the time of the acceleration which priority is given [acceleration] over said fuel cut prohibition means, and stops the fuel supply to an engine compulsorily during control of the amount of supplementary airs by said amount control means of supplementary airs when acceleration operational status is detected by said operational status detection means.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the configuration of invention according to claim 3.
[Drawing 2] The system configuration Fig. of the engine in the gestalt of the 1st operation.
[Drawing 3] The flow chart which shows the contents of the amount control of supplementary airs in the gestalt of the 1st operation.
[Drawing 4] Drawing showing correlation with the boost of no load and a flame-failure marginal boost, and a target boost.
[Drawing 5] The system configuration Fig. of the engine in the gestalt of the 2nd operation.
[Drawing 6] The flow chart which shows the contents of the amount control of supplementary airs in the gestalt of the 2nd operation.
[Drawing 7] The flow chart which shows the contents of the amount control of supplementary airs in the gestalt of the 3rd operation.
[Drawing 8] The flow chart which shows the contents of the amount control of supplementary airs in the gestalt of the 4th operation.
[Drawing 9] The system configuration Fig. of the engine in which the gestalt of the 5th operation is shown.
[Drawing 10] Drawing showing the drive circuit of the cut valve in the gestalt of the 5th operation.
[Drawing 11] The flow chart which shows the contents of the amount control of supplementary airs in the gestalt of the 6th operation.
[Drawing 12] The flow chart which shows the contents of the amount control of supplementary airs in the gestalt of the 7th operation.
[Drawing 13] The flow chart which shows the contents of the amount control of supplementary airs in the gestalt of the 8th operation.
[Description of Notations]
1 Engine
3 Throttle Valve
5 Fuel Injection Valve
8 Catalyst
10 Control Unit
11 Air Flow Meter
12 Position Sensor
13 Reference Sensor
15 Air-fuel Ratio Sensor
16 Throttle Sensor
17 Coolant Temperature Sensor
18 Boost Sensor
21 Bypass Path
22 The Amount Control Valve of Supplementary Airs
23 Cut Valve

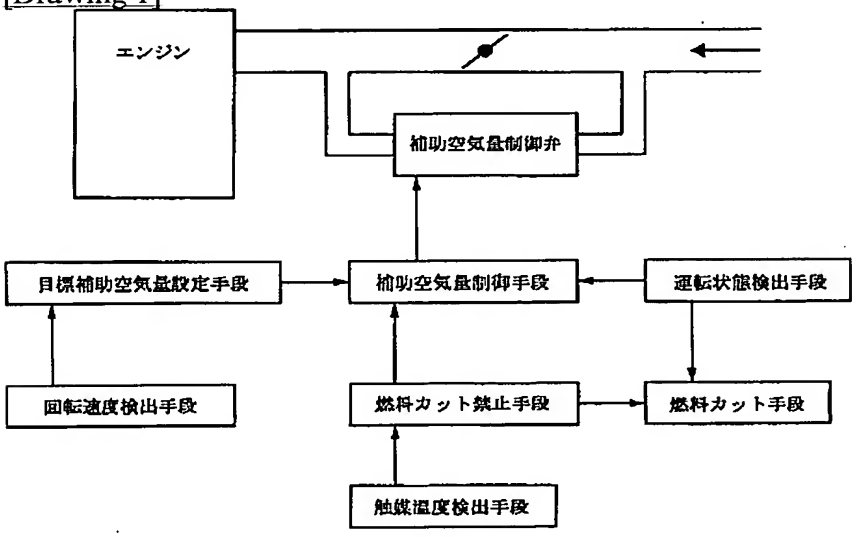
[Translation done.]

* NOTICES *

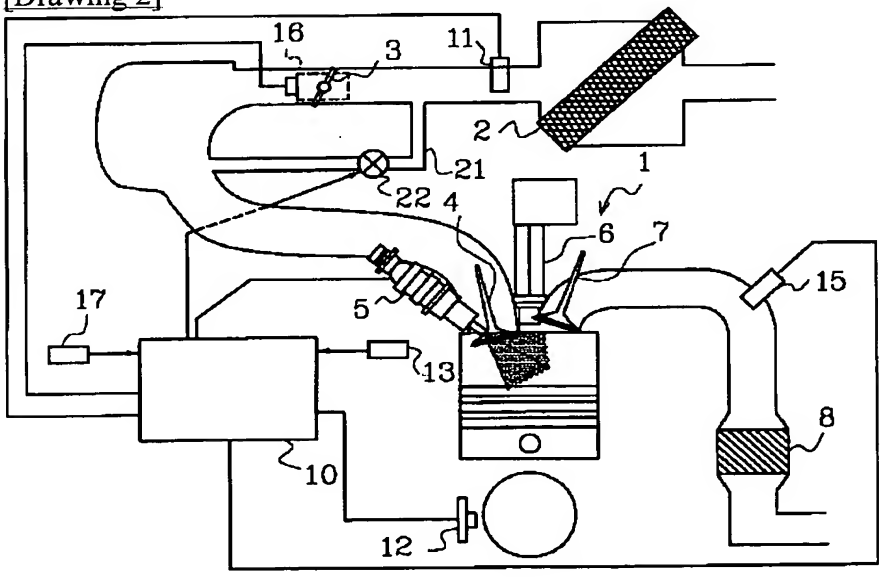
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

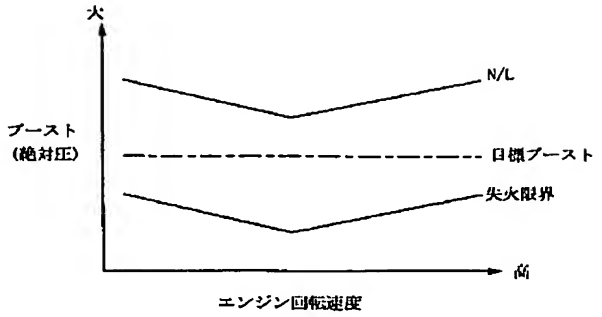
[Drawing 1]



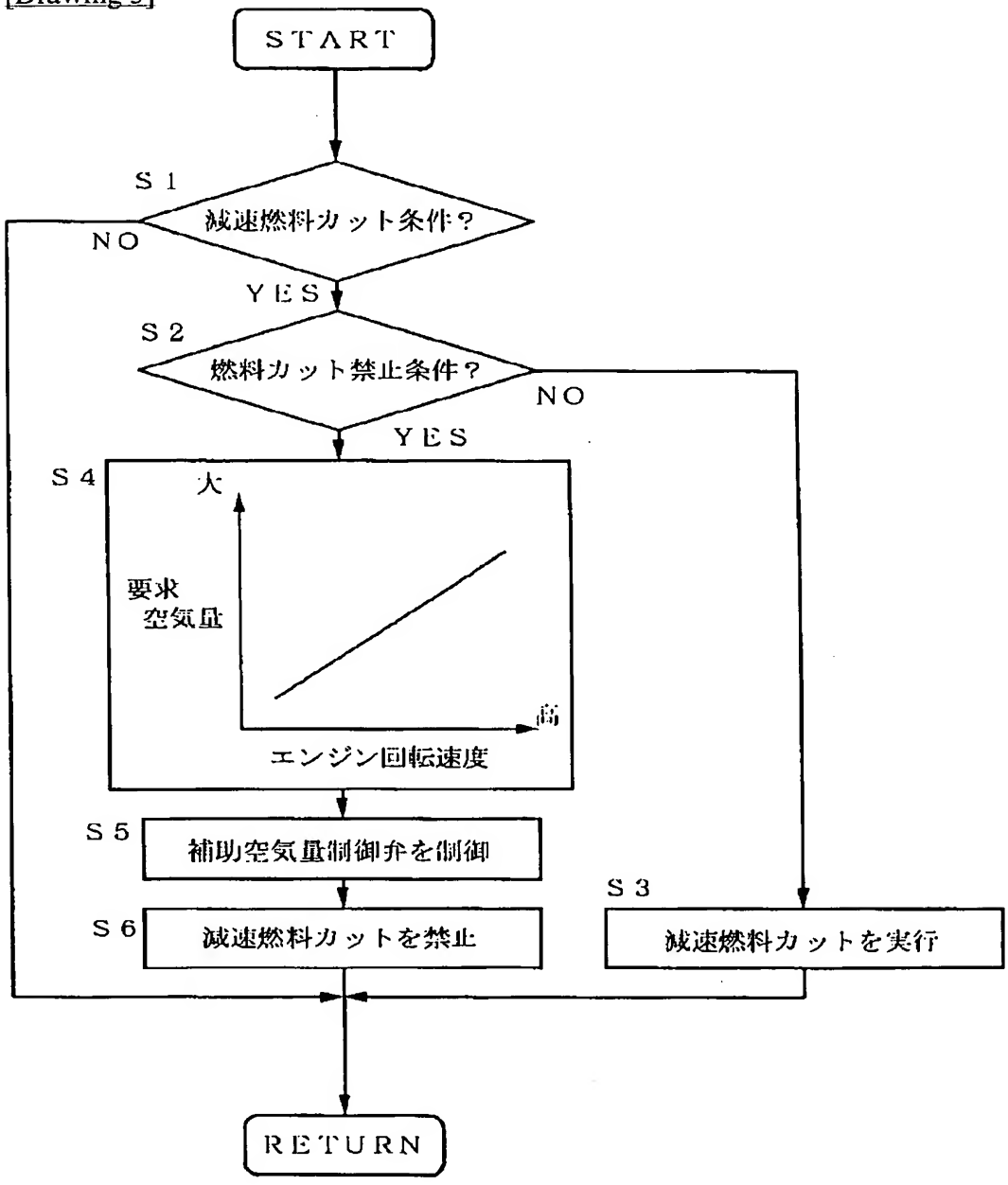
[Drawing 2]



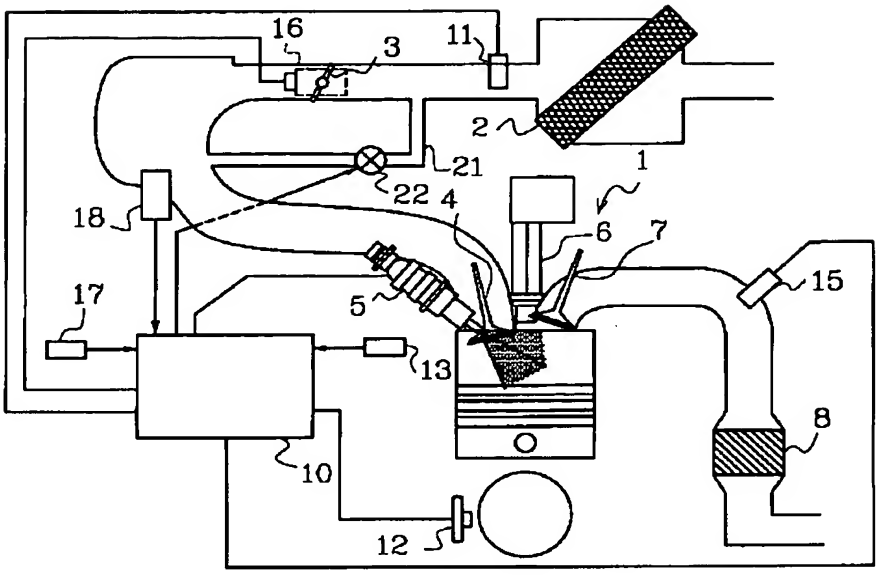
[Drawing 4]



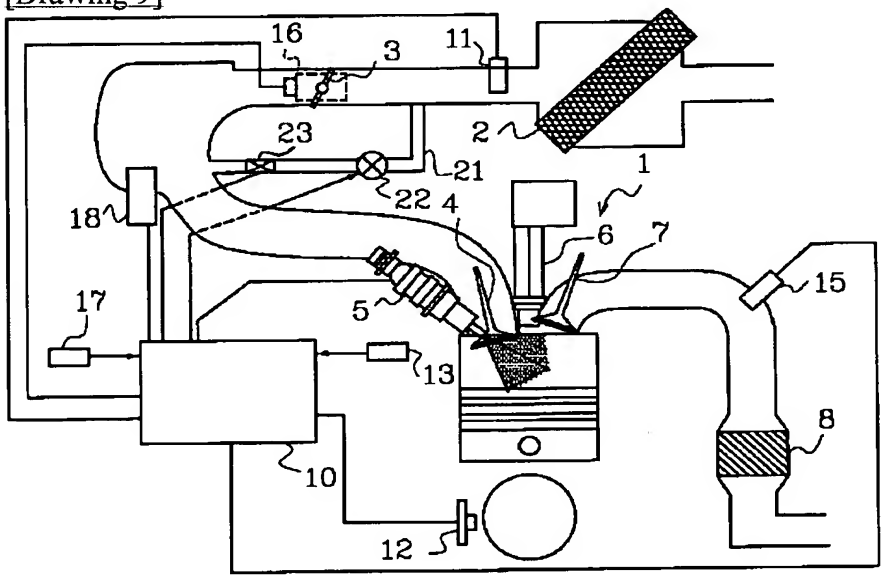
[Drawing 3]



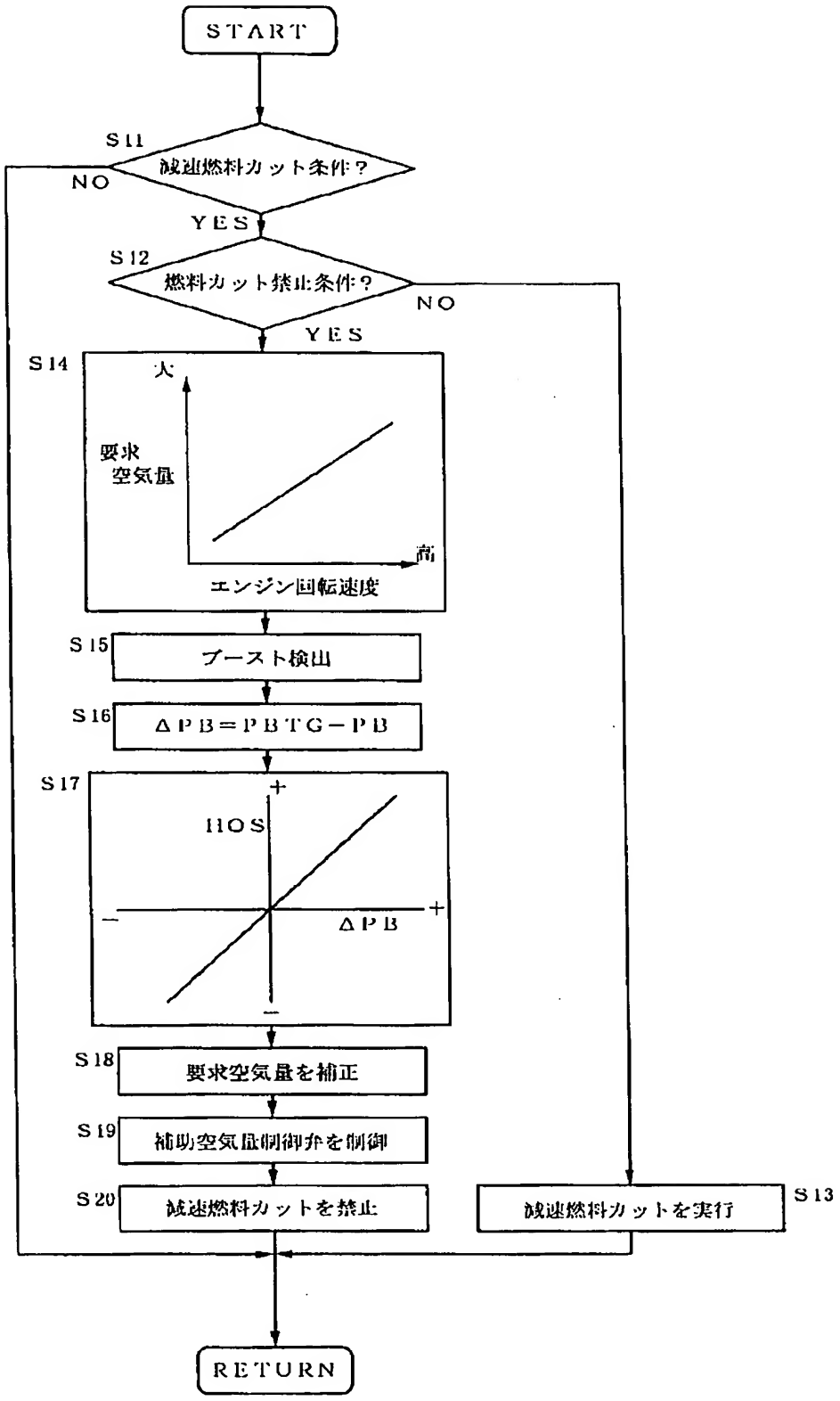
[Drawing 5]



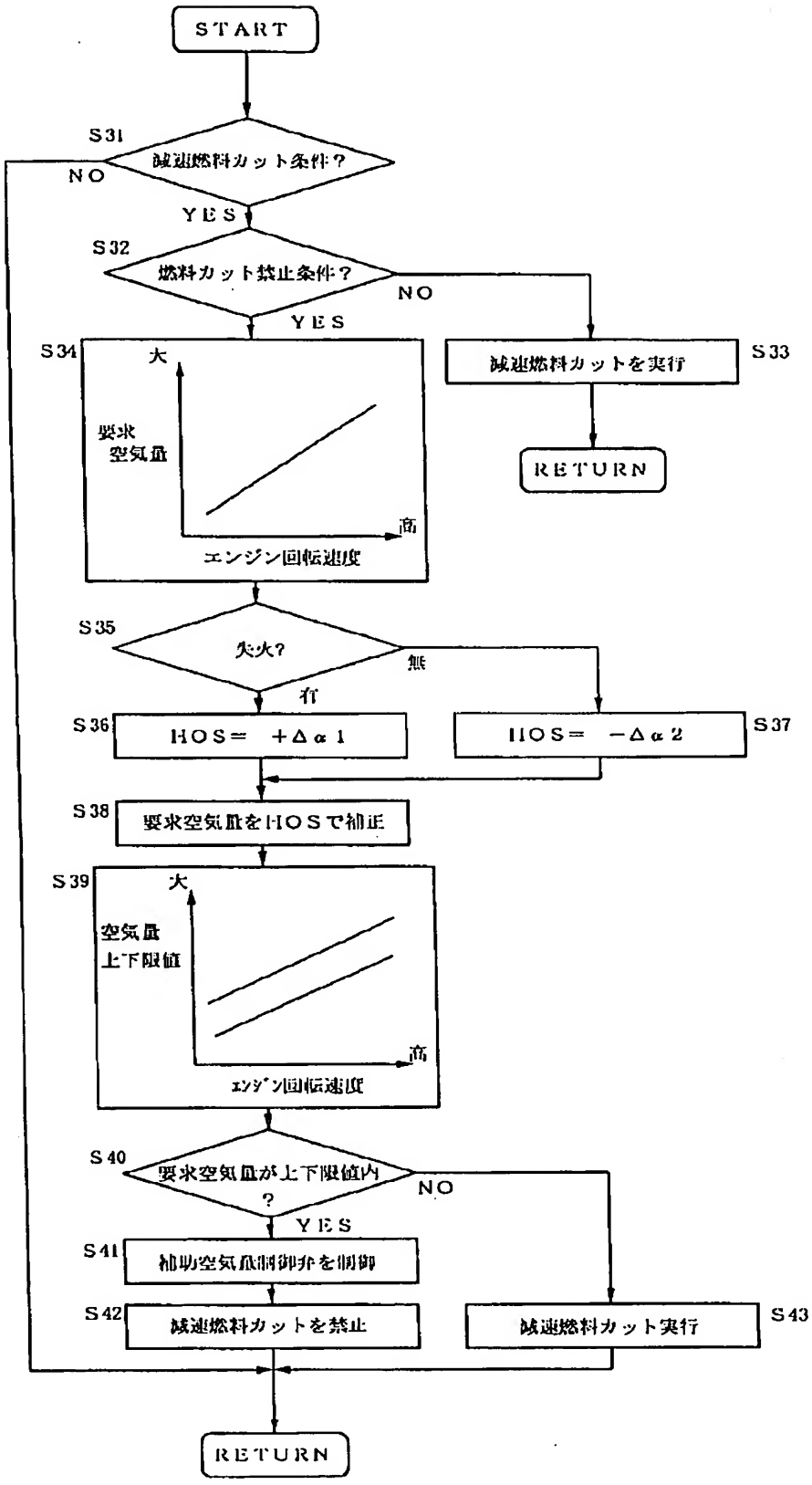
[Drawing 9]



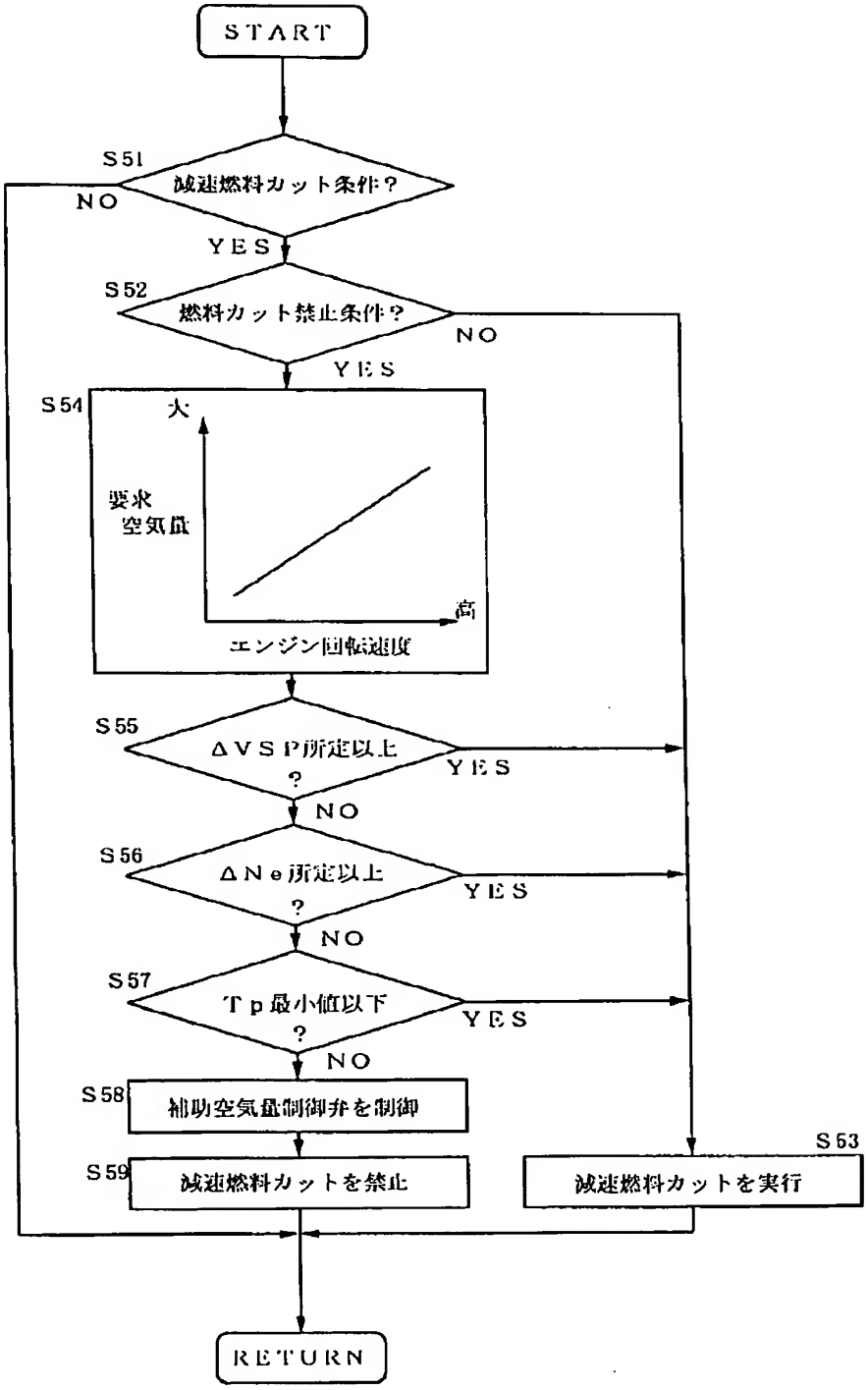
[Drawing 6]


START
S11
減速燃料カット条件？
NO
YES
S12
燃料カット禁止条件？
NO
YES
S14
大
要求
空気量
高
エンジン回転速度
S15
ブースト検出
S16
ΔPB＝PBTG－PB
S17
+
HOS
－
ΔPB
+
－
S18
要求空気量を補正
S19
補助空気量制御弁を制御
S20
減速燃料カットを禁止
減速燃料カットを実行
S13
RETURN

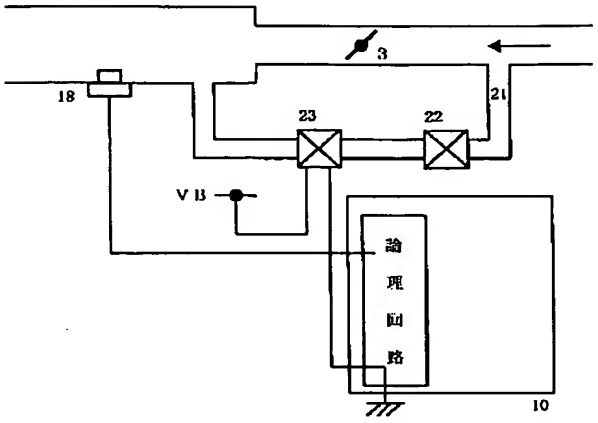
[Drawing 7]


START
S31
減速燃料カット条件？
NO
YES
S32
燃料カット禁止条件？
NO
YES
S33
減速燃料カットを実行
RETURN
S34
大
要求
空気量
高
エンジン回転速度
S35
失火?
無
有
S36
HOS＝ ＋Δα1
S37
HOS＝ －Δα2
S38
要求空気量をHOSで補正
S39
大
空気量
上下限値
高
エンジン回転速度
S40
要求空気量が上下限値内
？
NO
YES
S41
補助空気量制御弁を制御
S42
減速燃料カットを禁止
S43
減速燃料カット実行
RETURN

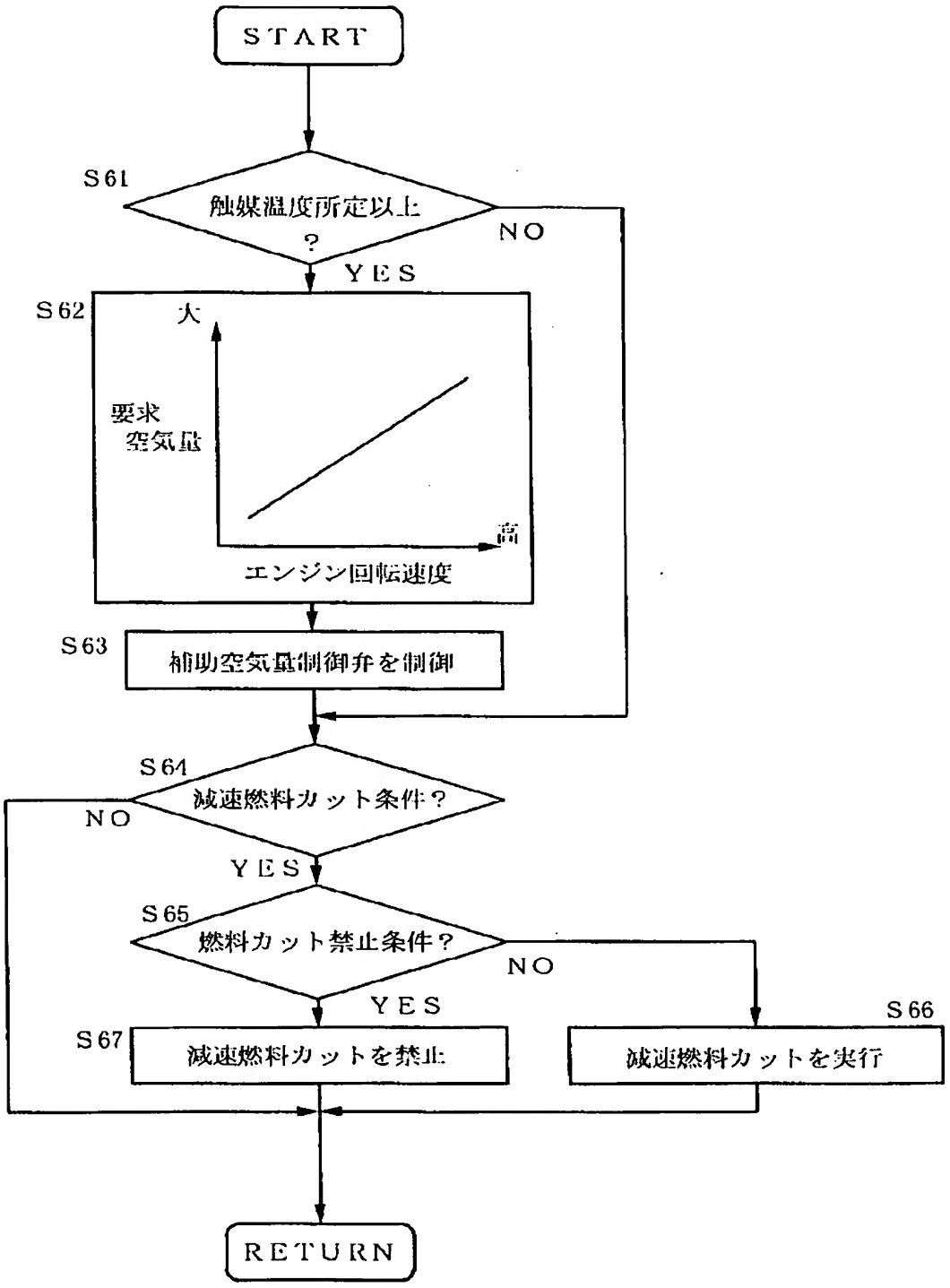
[Drawing 8]


START
S51
減速燃料カット条件？
NO
YES
S52
燃料カット禁止条件？
NO
YES
S54
大
要求
空気量
高
エンジン回転速度
S55
ΔVSP所定以上
？
YES
NO
S56
ΔNe所定以上
？
YES
NO
S57
Tp最小値以下
？
YES
NO
S58
補助空気量制御弁を制御
S59
減速燃料カットを禁止
S53
減速燃料カットを実行
RETURN

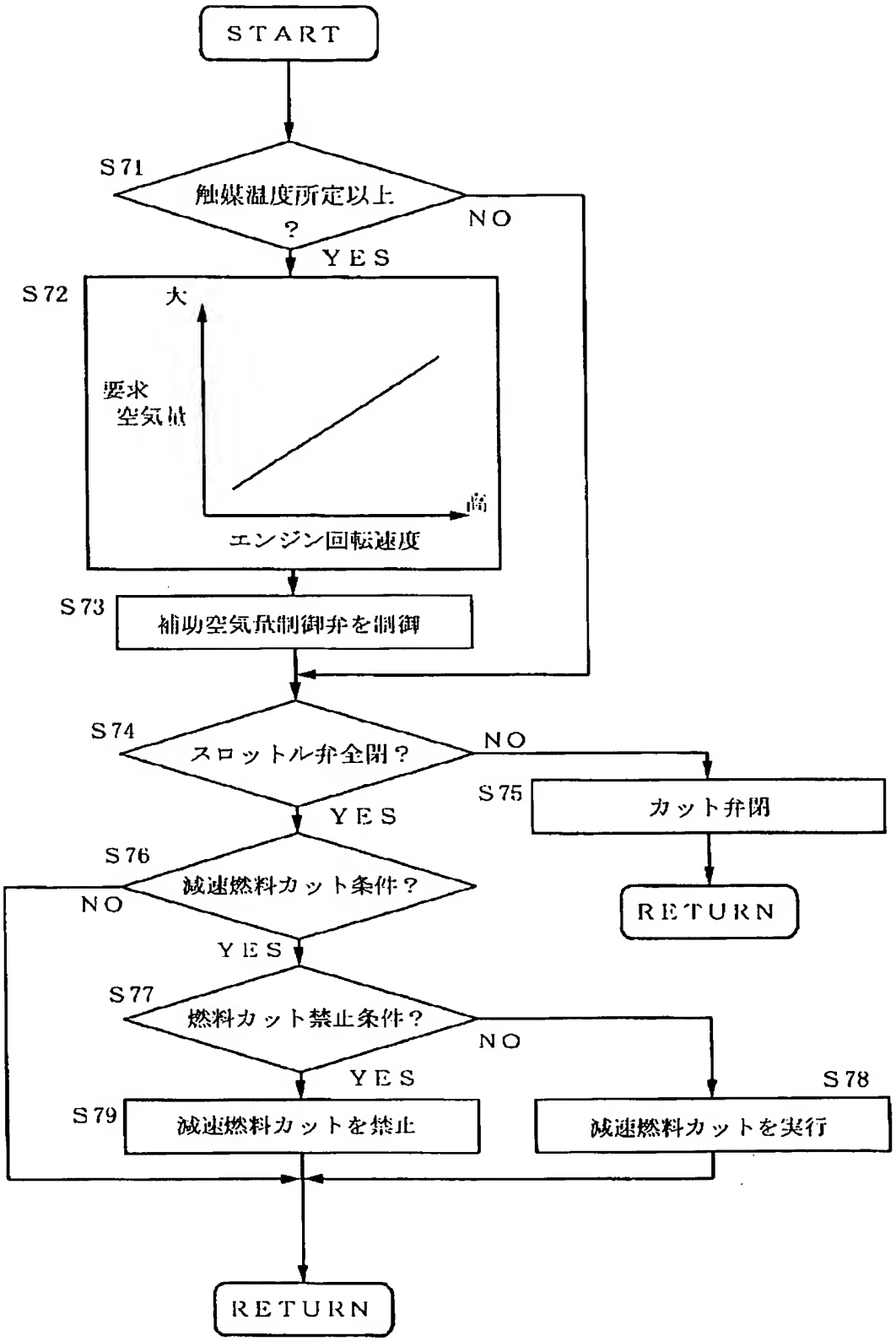
[Drawing 10]



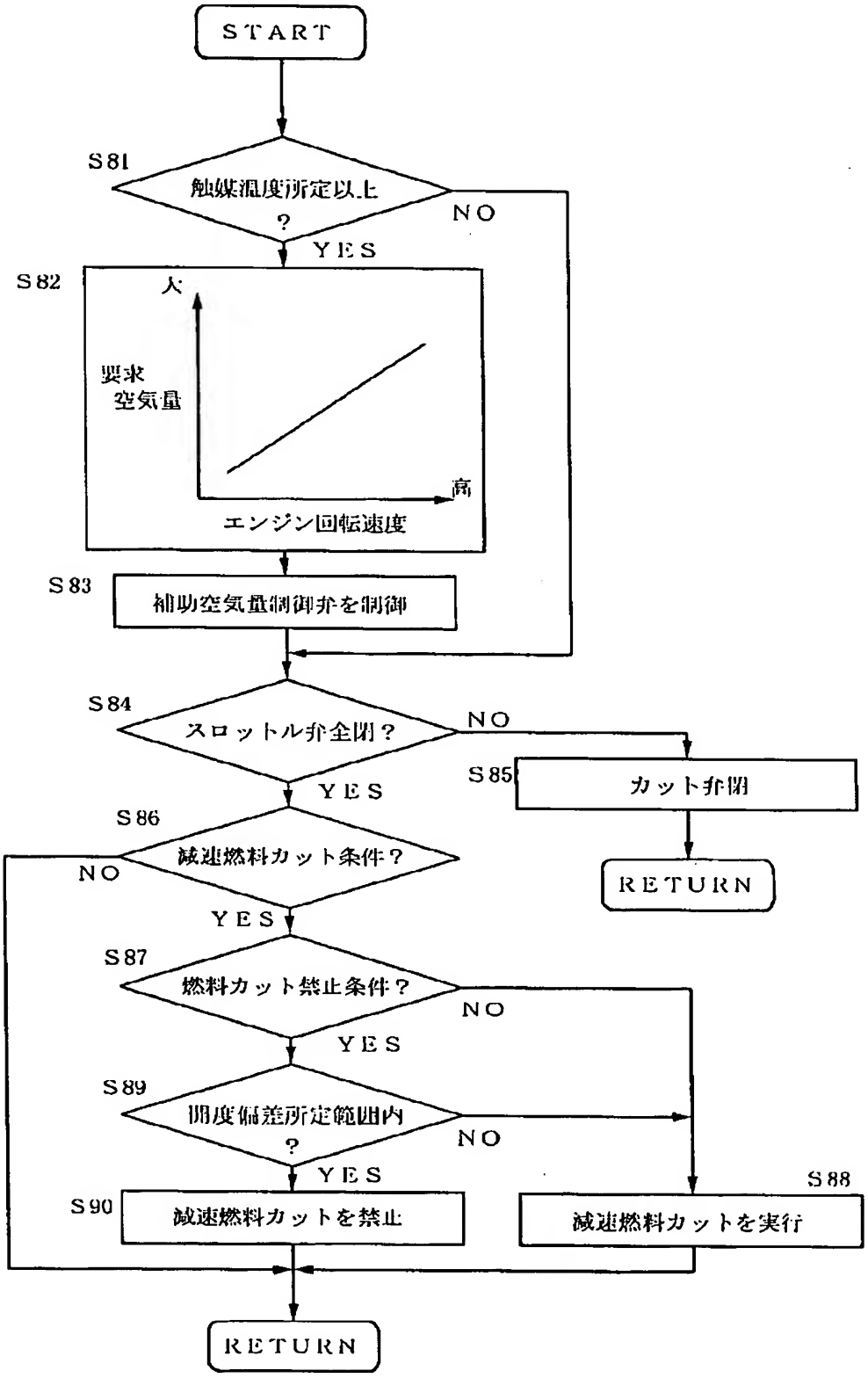
[Drawing 11]


START
S61
触媒温度所定以上
？
NO
YES
S62
大
要求
空気量
高
エンジン回転速度
S63
補助空気量制御弁を制御
S64
減速燃料カット条件？
NO
YES
S65
燃料カット禁止条件？
NO
YES
S66
S67
減速燃料カットを禁止
減速燃料カットを実行
RETURN

[Drawing 12]


START
S71
触媒温度所定以上
？
NO
YES
S72
大
要求
空気量
高
エンジン回転速度
S73
補助空気量制御弁を制御
S74
スロットル弁全閉？
NO
S75
カット弁閉
YES
RETURN
S76
減速燃料カット条件？
NO
YES
S77
燃料カット禁止条件？
NO
YES
S78
S79
減速燃料カットを禁止
減速燃料カットを実行
RETURN

[Drawing 13]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号

特開平11－107825

(43)公開日　平成11年(1999)４月20日

(51)Int.Cl.[6]	識別記号	ＦＩ		
Ｆ０２Ｄ　41/12	３１５	Ｆ０２Ｄ　41/12	３１５	
	３３０		３３０Ｋ	
Ｐ０２Ｍ　69/32			41/32	Ｄ
Ｆ０２Ｄ　41/32			33/00	３１８Ａ

審査請求　未請求　請求項の数11　ＯＬ　（全 19 頁）

(21)出願番号　特願平9－269935

(22)出願日　平成９年(1997)10月２日

(71)出願人　000003997
日産自動車株式会社
神奈川県横浜市神奈川区宝町２番地

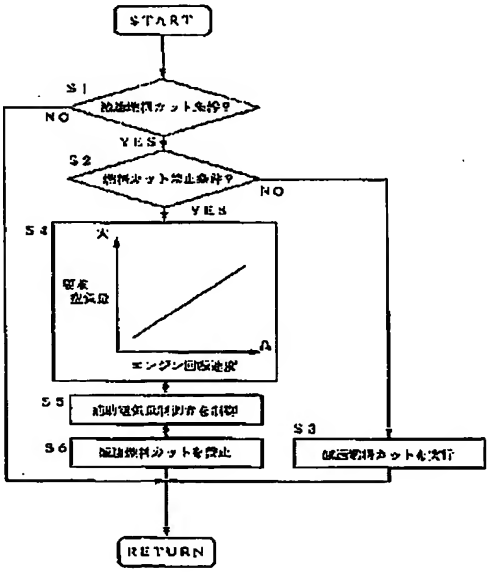
(72)発明者　森　浩一
神奈川県横浜市神奈川区宝町２番地　日産自動車株式会社内

(72)発明者　佐藤　立男
神奈川県横浜市神奈川区宝町２番地　日産自動車株式会社内

(74)代理人　弁理士　笹島　富二雄

(54)【発明の名称】　エンジンの空気量制御装置

(57)【要約】
【課題】触媒温度が高いために減速燃料カットを禁止したときに、失火、加速を招くことのない適正な空気量に制御する。
【解決手段】スロットル弁が全閉でかつエンジン回転速度が所定速度以上である減速運転時に燃料カットを行わせるか（Ｓ１）、触媒の温度が所定値以上であるときには、前記減速燃料カットを禁止する（Ｓ２）。そして、減速燃料カットを禁止するときには、スロットル弁をバイパスしてエンジンに供給される補助空気量を、目標ブーストになるようにエンジン回転速度に応じて制御する（Ｓ４，Ｓ５）。



1

【特許請求の範囲】

【請求項１】燃焼を伴うエンジンの被駆動運転状態において、エンジンに供給される空気量をエンジン回転速度が高いときほど多くすることを特徴とするエンジンの空気量制御装置。

【請求項２】エンジンの運転状態を検出する運転状態検出手段と、

エンジンに供給される空気量を制御する空気量制御弁と、

エンジンの回転速度を検出する回転速度検出手段と、

前記運転状態検出手段で燃焼を伴うエンジンの被駆動運転状態が検出されているときに、前記回転速度検出手段で検出される回転速度が高いときほどエンジンに供給される空気量が多くなるように前記空気量制御弁を制御する空気量制御手段と、

を含んで構成されることを特徴とするエンジンの空気量制御装置。

【請求項３】エンジンの運転状態を検出する運転状態検出手段と、

該運転状態検出手段でエンジンの所定の被駆動運転状態が検出されているときに、エンジンへの燃料供給を停止させる燃料カット手段と、

エンジンの排気通路に介装された触媒の温度を検出する触媒温度検出手段と、

該触媒温度検出手段で検出される触媒の温度が所定値以上であるときに、前記燃料カット手段による燃料供給の停止を禁止する燃料カット禁止手段と、

スロットル弁をバイパスするバイパス通路に介装され、該バイパス通路からエンジンに供給される補助空気量を制御する補助空気量制御弁と、

エンジンの回転速度を検出する回転速度検出手段と、

エンジンに供給される目標補助空気量を、前記回転速度検出手段で検出される回転速度が高いときほど大きく設定する目標補助空気量設定手段と、

エンジンが前記所定の被駆動運転状態であり、かつ、前記燃料カット禁止手段によって燃料供給の停止が禁止されるときに、エンジンに供給される補助空気量が前記目標空気量設定手段で設定される目標補助空気量となるよう前記補助空気量制御弁を制御する補助空気量制御手段と、

を含んで構成されることを特徴とするエンジンの空気量制御装置。

【請求項４】エンジンの吸入負圧に応じてエンジンが前記所定の被駆動運転状態のときに開弁するカット弁を前記バイパス通路に介装したことを特徴とする請求項３記載のエンジンの空気量制御装置。

【請求項５】前記補助空気量制御手段は、前記触媒温度検出手段で検出された触媒の温度が前記所定値以上であるときに、前記補助空気量制御弁の開度を前記目標補助空気量に対応する目標開度に予め制御しておくことを特

2

徴とする請求項４記載のエンジンの空気量制御装置。

【請求項６】エンジンの運転状態が前記所定の被駆動運転状態に移行したときの前記補助空気量制御弁の開度と前記目標開度との差が所定値以上であるときに、前記燃料カット禁止手段に優先してエンジンへの燃料供給を強制的に停止させる開度差による燃料カット強制手段を設けたことを特徴とする請求項５記載のエンジンの空気量制御装置。

【請求項７】吸入負圧の状態に優先してスロットル弁の閉状態において前記カット弁を閉状態に保持することを特徴とする請求項４～６のいずれか１つに記載のエンジンの空気量制御装置。

【請求項８】エンジンの吸入負圧を絶対圧として検出する吸入負圧検出手段を備え、

前記目標補助空気量設定手段は、検出された回転速度と吸入負圧とに応じて目標補助空気量を設定することを特徴とする請求項３～７のいずれか１つに記載のエンジンの空気量制御装置。

【請求項９】エンジンの失火を検出する失火検出手段を備え、

前記目標補助空気量設定手段は、検出された回転速度と失火の有無に応じて目標補助空気量を設定することを特徴とする請求項３～８のいずれか１つに記載のエンジンの空気量制御装置。

【請求項１０】前記補助空気量制御手段で制御される補助空気量が所定範囲を越えるときに、前記燃料カット禁止手段に優先してエンジンへの燃料供給を強制的に停止させる補助空気量による燃料カット強制手段を設けたことを特徴とする請求項３～９のいずれか１つに記載のエンジンの空気量制御装置。

【請求項１１】前記補助空気量制御手段による補助空気量の制御中に、前記運転状態検出手段で加速運転状態が検出されたときには、前記燃料カット禁止手段に優先してエンジンへの燃料供給を強制的に停止させる加速時燃料カット強制手段を設けたことを特徴とする請求項３～１１のいずれか１つに記載のエンジンの空気量制御装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、エンジンの空気量制御装置に関し、詳しくは、燃料カットが禁止されるエンジンの被駆動運転状態においてエンジンの吸入空気量を適切に制御するための技術に関する。

【０００２】

【従来の技術】従来から、エンジンの被駆動運転状態である減速運転状態においてエンジンへの燃料供給を停止させる減速燃料カットが知られているが、排気浄化を行う触媒の温度が高い条件下で前記減速燃料カットが実行されると、触媒劣化の進行が速まるため、触媒温度が高いときに前記減速燃料カットを禁止し、通常に燃料を供

【００１５】請求項４記載の発明では、エンジンの吸入負圧に応じてエンジンが前記所定の被駆動運転状態のときに開弁するカット弁を前記バイパス通路に介装する構成とした。かかる構成によると、補助空気量制御弁が開いていても、カット弁が閉じていれば、バイパス通路を介した補助空気の供給は行われないことになり、また、前記カット弁が吸入負圧に応じて開閉されるから、補助空気の供給が必要な吸入負圧の大きな状態（真空を０とする絶対圧として小さい状態）においてのみバイパス通路を開くように設定し得る。

【００１６】請求項５記載の発明では、前記補助空気量制御手段は、前記触媒温度検出手段で検出された触媒の温度が前記所定値以上であるときに、前記補助空気量制御弁の開度を前記目標補助空気量に対応する目標開度に予め制御しておく構成とした。かかる構成によると、触媒温度が燃料カットの禁止が行われる高温状態であるときには、被駆動運転状態になる前に予め燃料供給が行われる被駆動運転状態に対応して補助空気量制御弁の開度を制御しておき、実際に被駆動運転状態に移行したときには前記カット弁の開制御によって直ちに要求空気量が得られるようにする。

【００１７】請求項６記載の発明では、エンジンの運転状態が前記所定の被駆動運転状態に移行したときの前記補助空気量制御弁の開度と前記目標開度との差が所定値以上であるときに、前記燃料カット禁止手段に優先してエンジンへの燃料供給を強制的に停止させる開度差による燃料カット強制手段を設ける構成とした。かかる構成によると、予め補助空気量制御弁の開度を制御しておく構成において、目標開度に達する前に被駆動運転状態に移行した場合であって、要求補助空気量が被駆動運転状態の初期から得られないときには、燃料カットを行わせ、空気量不足による失火の発生等を未然に回避する。

【００１８】請求項７記載の発明では、吸入負圧の状態に優先してスロットル弁の開状態において前記カット弁を閉状態に保持する構成とした。かかる構成によると、スロットル弁の開状態であるときには、カット弁を閉に保持し、通常走行状態での補助空気量の供給によるトルク変動を回避する。請求項８記載の発明では、エンジンの吸入負圧を絶対圧として検出する吸入負圧検出手段を備え、前記目標補助空気量設定手段は、検出された回転速度と吸入負圧とに応じて目標補助空気量を設定する構成とした。

【００１９】かかる構成によると、エンジン回転速度に基づいて補助空気量を制御すると共に、気圧の変化等によって前記回転速度に応じた補助空気量では所期の吸入負圧に制御できない分を、実際の吸入負圧（絶対圧）の検出結果に基づいて補正する。請求項９記載の発明では、エンジンの失火を検出する失火検出手段を備え、前記目標補助空気量設定手段は、検出された回転速度と失火の有無に応じて目標補助空気量を設定する構成とした。

【００２０】かかる構成によると、補助空気量が不足して失火が発生すると、該失火発生に基づいてエンジン回転速度に応じた補助空気量を増大修正することが可能である。請求項１０記載の発明では、前記補助空気量制御手段で制御される補助空気量が所定範囲を越えるときに、前記燃料カット禁止手段に優先してエンジンへの燃料供給を強制的に停止させる補助空気量による燃料カット強制手段を設ける構成とした。

【００２１】かかる構成によると、補助空気量（指示値）が通常要求される範囲を越えるときには、部品故障などによって目標の空気量に制御できない状態であって、失火や加速が生じる可能性があるものと推定し、燃料カットを実行することで、失火，加速の発生を防止する。請求項１１記載の発明では、前記補助空気量制御手段による補助空気量の制御中に、前記運転状態検出手段で加速運転状態が検出されたときには、前記燃料カット禁止手段に優先してエンジンへの燃料供給を強制的に停止させる加速時燃料カット強制手段を設ける構成とした。

【００２２】かかる構成によると、補助空気量の制御中に加速したときには、要求量よりも多い補助空気量が供給されているものと判断し、燃料カットを実行することで加速状態の解消を図る。

【００２３】

【発明の効果】請求項１又は請求項２記載の発明によると、被駆動運転状態における空気量をエンジン回転速度毎に適正量に制御でき、失火，加速を招くことなく燃焼させることができるという効果がある。請求項３記載の発明によると、燃料カットによる触媒劣化を抑制できると共に、触媒劣化を抑制すべく燃料カットを禁止したときに、失火，加速を招くことのない空気量に制御できるという効果がある。

【００２４】請求項４記載の発明によると、必要のない状態での補助空気量の供給を回避できるという効果がある。請求項５記載の発明によると、事前に補助空気量制御弁の開度を減速時に要求される開度に制御しておくことができ、以て、空気量制御の応答性を改善できるという効果がある。

【００２５】請求項６記載の発明によると、補助空気量制御弁の開度が目標開度にまで到達していない状態のまま燃焼を伴う被駆動運転状態に移行することを回避できるという効果がある。請求項７記載の発明によると、スロットル弁が開かれているときに不要な補助空気量の供給によってトルク変動が生じることを確実に防止できるという効果がある。

【００２６】請求項８記載の発明によると、気圧の変化等があっても、目標の吸入負圧（空気量）に精度良く制御できるという効果がある。請求項９記載の発明によると、空気量不足による失火の発生を確実に防止できると

いう効果がある。請求項10記載の発明によると、部品故障等によって要求空気量に制御できない状態を判断して燃料カットを実行させることで、失火、加速を伴う燃焼を回避できるという効果がある。

【００２７】請求項11記載の発明によると、空気量過剰による加速の発生を確実に防止できるという効果がある。

【００２８】

【発明の実施の形態】以下、本発明の実施の形態を説明する。図２は、第１の実施の形態におけるエンジンのシステム構成を示す図であり、エンジン１には、エアクリーナ２で濾過された空気が、スロットル弁３で計量され、吸気弁４を介してシリンダ内に吸引される。

【００２９】エンジン１の各気筒には、燃焼室内に直接燃料（ガソリン）を噴射する電磁式の燃料噴射弁５がそれぞれに設けられ、該燃料噴射弁５から噴射された燃料によってシリンダ内に混合気が形成される。シリンダ内の混合気は、点火栓６による火花点火によって着火燃焼し、燃焼排気は、排気弁７を介して排出され、触媒８で浄化されて大気中に放出される。

【００３０】本実施の形態におけるエンジン１は、上記構成により直噴式火花点火エンジンを構成するが、燃料噴射弁５が吸気ポート部分に燃料を噴射するポート噴射式火花点火エンジンであっても良い。マイクロコンピュータを内蔵したコントロールユニット10は、各種センサからの検出信号に基づく演算処理によって、前記燃料噴射弁５による燃料噴射及び点火栓６による点火（図示しない点火コイルへの通電）を制御する。

【００３１】前記各種センサとしては、吸入空気流量Ｑを検出するエアフローメータ11、１°ＣＡ毎にポジション信号ＰＯＳを出力するポジションセンサ12、基準クランク角度毎にリファレンス信号（基準角度信号）ＲＥＦを出力するリファレンスセンサ13、燃焼混合気の空燃比を検出する空燃比センサ15、前記スロットル弁３の開度ＴＶＯを検出するスロットルセンサ16、冷却水温度Ｔｗを検出する水温センサ17等が設けられている。

【００３２】尚、前記ポジション信号ＰＯＳ又はリファレンス信号ＲＥＦに基づいてコントロールユニット10がエンジン回転速度Ｎｅを算出するようになっており、回転速度検出手段として機能は、前記ポジションセンサ12又はリファレンスセンサ13とコントロールユニット10とによって実現される。更に、スロットル弁３をバイパスしてバイパス通路21が設けられると共に、該バイパス通路21には、ステップモータ等のアクチュエータで開度制御可能に開閉駆動される補助空気量制御弁22（空気量制御弁）が介装されており、コントロールユニット10は、前記補助空気量制御弁22の開度を制御することによって、前記バイパス通路21を介してエンジンに供給される補助空気量を制御する。

【００３３】前記コントロールユニット10は、エアフローメータ11で検出される吸入空気流量Ｑ、及び、ポジション信号ＰＯＳ又はリファレンス信号ＲＥＦに基づいて算出されるエンジン回転速度Ｎｅに基づいて、基本燃料噴射量Ｔｐを演算する一方、この基本燃料噴射量Ｔｐを冷却水温度Ｔｗや空燃比センサ15で検出される空燃比等に基づいて補正して、最終的な燃料噴射量Ｔｉを演算する。そして、所定の噴射タイミングにおいて前記燃料噴射量Ｔｉに相当するパルス幅の噴射パルス信号を前記燃料噴射弁５に出力することで、エンジン１への燃料供給を制御する。

【００３４】また、コントロールユニット10は、スロットル弁３が全閉でかつエンジン回転速度Ｎｅが所定速度以上の減速運転時（所定の被駆動運転状態）には、前記燃料噴射弁５による燃料噴射を停止させる制御（以下、減速燃料カットという）を行って、ＨＣ排出量の抑制と燃費向上を図る（燃料カット手段）。但し、触媒８の温度が高い状態で燃料カットが実行されると、触媒８を劣化させることになってしまうので、触媒８の温度が所定温度以上であるときに減速燃料カットを禁止するようになっている（燃料カット禁止手段）。

【００３５】そして、減速燃料カットが禁止される状態において、コントロールユニット10は、図３のフローチャートに示すようにして、前記補助空気量制御弁22を制御して、燃焼を伴う減速運転時の空気量を制御している。図３のフローチャートにおいて、ステップ１（図中にはＳ１と記してある。以下同様）では、減速燃料カット条件であるか否かを判別する。

【００３６】そして、減速燃料カット条件であれば、ステップ２へ進み、触媒８の温度に基づいて減速燃料カットを禁止すべき条件であるか否かを判別する。触媒８の温度は、直接温度センサで検出しても良いし、また、エンジン負荷、エンジン回転速度Ｎｅ等から推定する構成であっても良い（触媒温度検出手段）。

【００３７】触媒温度が低く減速燃料カットを実行し得る条件のときには、ステップ３へ進み、減速燃料カットを実行させる。一方、触媒温度が高く減速燃料カットが禁止されるときには、通常に燃料噴射が行われることになるが、スロットル弁３が全閉に閉じられることによって負圧が高くなって空気量が不足し失火が生じる可能性があるため、前記補助空気量制御弁22によって空気量を制御する。

【００３８】具体的には、ステップ４へ進み、予めエンジン回転速度Ｎｅに対応して目標補助空気量を記憶させてあるテーブルを参照し、そのときのエンジン回転速度Ｎｅに対応する目標補助空気量を検索する（目標補助空気量設定手段）。前記目標補助空気量は、エンジン回転速度Ｎｅが高いときほど大きな値に設定されており、これによって、エンジン回転速度Ｎｅによって異なる要求空気量の違いに対応して、適正な補助空気量に制御できる。即ち、前記エンジン回転速度Ｎｅに応じた目標補助

空気量は、図4に示すように、失火限界のブーストと、N／L（ノーロード）相当のブーストとの間の目標ブースト（絶対圧）が得られる値として予め設定される結果．エンジン回転速度Neが高いときほど大きな値に設定されるものであり、これにより、失火の発生を回避しつつ．エンジンが加速してしまうことのない空気量に制御できる。

【0039】上記ステップ1，2の部分が、燃焼を伴う減速運転（被駆動運転）を検出する運転状態検出手段に相当する。ステップ5では．前記ステップ4で設定した目標補助空気量が得られる開度に前記補助空気量制御弁22の開度を制御する（空気量制御手段．補助空気量制御手段）。

【0040】ステップ6では、前記ステップ2での判別結果を受けて燃料カットを禁止し（燃料カット禁止手段）．前記補助空気量制御弁22を介して補助空気量が得られる状態で燃焼を行わせる。図5は．第2の実施の形態を示すエンジンのシステム構成図であり、図2に対して．エンジン1のブースト（吸入負圧）を、真空を0とする絶対圧として検出するブーストセンサ18（吸入負圧検出手段）を備える点のみが異なる。尚、以下．ブーストは絶対圧で示されるものとする。

【0041】そして、第2の実施の形態では、図6のフローチャートに示すようにして、燃料カットが禁止される減速運転状態において補助空気量制御弁22を制御する。図6のフローチャートにおいて．ステップ11では、減速燃料カットの条件であるか否かを判別し、条件が成立しているときには、ステップ12で．触媒8の温度に基づいて減速燃料カットを禁止すべき状態であるか否かを判別する。

【0042】そして、触媒8の温度が低いときには、ステップ13へ進んで、減速燃料カットを実行させる。一方．触媒8の温度が高く減速燃料カットを禁止すべき条件であるときには、ステップ14へ進み．前記ステップ4と同様に、エンジン回転速度Neに基づいて目標補助空気量を設定する（目標補助空気量設定手段）。

【0043】ステップ15では、前記ブーストセンサ18で検出されたブーストPB（真空を0とする絶対圧）を読み込む。ステップ16では．前記エンジン回転速度Neに基づく目標補助空気量の設定において目標としたブーストPBTGと．前記検出された実際のブーストPBとの偏差ΔPBを演算する（ΔPB＝PBTG－PB）。

【0044】ステップ17では、予め前記偏差ΔPBに応じて補正空気量HOSを記憶したテーブルを参照し、前記ステップ16で演算した偏差ΔPBに対応する補正空気量HOSを求める。上記ステップ17における補正空気量HOSのテーブルは、前記偏差ΔPBの絶対値が大きいほど補正量HOSの絶対値も大きくなり、また．前記偏差ΔPBが正であって、実際のブーストPBが目標ブーストPBTGよりも低いとき（実際のブーストの方がより真空に近いとき）には．補正量HOSとして正の値が設定され、目標補助空気量が増大補正され、逆に．前記偏差ΔPBが負であって．実際のブーストPBが目標ブーストPBTGよりも高いとき（目標のブーストの方がより真空に近いとき）には．補正量HOSとして負の値が設定され、目標補助空気量が減少補正されるようになっている。即ち．前記補正量HOSによって目標補助空気量を補正することで、気圧の変化等があっても．目標ブーストPBTGを得られる補助空気量を精度良く設定できるようになっている。

【0045】ステップ17で補正量HOSを設定すると、ステップ18では．前記ステップ14で設定した目標補助空気量に前記補正量HOSを加算して修正し、ステップ19では．前記修正された目標補助空気量に基づいて前記補助空気量制御弁22の開度を制御する。そして、ステップ20では、減速燃料カットを禁止し、上記ステップ19による開度制御の結果として補助空気量が得られる状態で燃焼を行わせる。

【0046】図7のフローチャートは．第3の実施の形態における補助空気量制御の様子を示すものである。尚．この第3の実施の形態における制御内容は．図2に示した第1の実施の形態におけるシステム構成に適用されるものとして以下に説明する。図7のフローチャートにおいて、ステップ31では．減速燃料カット条件を判別し．条件成立時にはステップ32へ進み．触媒温度に基づいて燃料カットを禁止すべき状態であるか否かを判別する。

【0047】そして、触媒温度が低く減速燃料カットを実行できるときには、ステップ33へ進んで、減速燃料カットを実行する。一方、触媒温度が高く減速燃料カットを禁止すべき条件であるときには、ステップ34へ進み、前記ステップ4，14と同様に、エンジン回転速度Neに応じて目標補助空気量を設定する。

【0048】ステップ35では、エンジン1において失火が発生しているか否かを判別する。失火の検出は．エンジン回転速度Neの変動に基づいて検知でき、また．筒内圧センサを備える場合であれば、該センサで検出される筒内圧に基づいて検知できる（失火検出手段）。ステップ35で失火が発生していると判別されたときには、ステップ36へ進み．補正空気量HOSを所定値Δα1だけ増大させ、失火が発生していないと判別されたときには．ステップ37へ進み、前記補正空気量HOSを所定値Δα2（＜Δα1）だけ減少させる。即ち、失火が発生しているときには空気量不足を判断して、補助空気量を増大させる一方．失火が発生していないときには空気の過剰供給による加速を回避すべく、補助空気量を減少させるものである。

【0049】ステップ38では、前記補正量HOSによって前記ステップ34で設定された目標補助空気量を補正する。ステップ39では、補助空気量の上下限値を．エンジ

ン回転速度Ｎｅに基づいて設定する。前記上下限値は、前記図４に示したノーロード，失火限界のブーストに対応して設定される。

【００５０】ステップ40では、前記ステップ38で補正量ＨＯＳによる補正設定で得られた目標補助空気量が、前記ステップ39で設定した上下限値で挟まれる範囲内であるか否かを判別する。ステップ40で目標補助空気量が上下限値で挟まれる範囲内であると判断されたときには、ステップ41へ進み、前記目標補助空気量に従って補助空気量制御弁22を制御し、ステップ42では、減速燃料カットを禁止する処理を行う。

【００５１】一方、ステップ40で目標補助空気量が上下限値で挟まれる範囲を越えていると判断されたときには、ステップ43へ進み、減速燃料カットを実行させる（補助空気量による燃料カット強制手段）。目標補助空気量が上下限値を越えているときには、補助空気量制御弁22の故障によって目標補助空気量が実際には得られておらず、失火が発生する状態、或いは、加速する状態で燃焼が行われている可能性がある。

【００５２】失火が発生すると、未燃ＨＣが触媒８で燃焼して触媒８の溶損を発生させる可能性があり、また、加速が生じると運転性を大きく損ねることになり、これらは、減速燃料カットの実行による触媒劣化の進行よりも優先的に対処すべき事項である。そこで、減速燃料カットを実行させて、少なくとも失火、加速が生じる状態での減速運転を避けるようにする。

【００５３】尚、ステップ40で目標補助空気量が上下限値で挟まれる範囲を越えていると判断されたときには、その後、イグニッションスイッチがＯＦＦされるまでの間は、たとえ触媒温度が高いときであっても、減速燃料カットが禁止されないようにすると良い。図８のフローチャートは、第４の実施の形態における補助空気量制御の様子を示すものである。尚、この第４の実施の形態における制御内容は、図２に示した第１の実施の形態におけるシステム構成に適用されるものとして以下に説明する。

【００５４】図８のフローチャートにおいて、ステップ51では、減速燃料カット条件を判別し、条件成立時にはステップ52へ進み、触媒温度に基づいて燃料カットを禁止すべき状態であるか否かを判別する。そして、触媒温度が低く減速燃料カットを実行できるときには、ステップ53へ進んで、減速燃料カットを実行する。

【００５５】一方、触媒温度が高く減速燃料カットを禁止すべき条件であるときには、ステップ54へ進み、前記ステップ４，14，34と同様に、エンジン回転速度Ｎｅに応じて目標補助空気量を設定する。ステップ55では、車速の変化△ＶＳＰ（△ＶＳＰ＝最新車速－前回車速）が所定値以上であって、車速ＶＳＰが増大変化を示しているか否かを判別する。

【００５６】そして、車速ＶＳＰが増大変化しているとき．換言すれば．車両が加速しているときには．減速燃料カットを禁止すべき条件下ではあるが、減速要求時の加速を確実に回避すべく．ステップ53へ進んで減速燃料カットを実行させる。一方．車速ＶＳＰが増大していないと判断されると、ステップ56へ進み．エンジン回転速度Ｎｅの変化△Ｎｅ（△Ｎｅ＝最新速度－前回速度）が所定値以上であって、エンジン回転速度Ｎｅが増大変化を示しているか否かを判別する。

【００５７】そして、エンジン回転速度Ｎｅが増大変化しているときにも、ステップ53へ進んで減速燃料カットを実行させる。上記のステップ55又はステップ56からステップ53へ進む処理が、加速時燃料カット強制手段に相当する。車速ＶＳＰ，エンジン回転速度Ｎｅが共に増大変化していないときには．ステップ57へ進み、基本燃料噴射量Ｔｐが最小値以上であるか否かを判別する。前記最小値とは、噴射時間に比例する噴射量が得られる最小噴射時間に相当するものである。基本燃料噴射量Ｔｐが最小値を下回るときには．空燃比制御性が低下して失火等が発生する可能性があるので、ステップ53へ進んで減速燃料カットを実行させる。

【００５８】車速ＶＳＰ．エンジン回転速度Ｎｅが共に増大変化してなく、かつ．基本燃料噴射量Ｔｐが最小値以上であるときには、ステップ58へ進み、目標補助空気量に応じて補助空気量制御弁22を制御し、ステップ59では．減速燃料カットを禁止する。尚．上記第４の実施の形態では、目標補助空気量を、エンジン回転速度Ｎｅのみに基づいて決定する構成としたが．第２の実施の形態のように、エンジン回転速度Ｎｅ及びブーストセンサ18の検出結果に基づいて目標補助空気量を決定する構成、或いは、第３の実施の形態のように．エンジン回転速度Ｎｅ及び失火検出の結果から目標補助空気量を決定する構成において．上記同様に．車速ＶＳＰ，エンジン回転速度Ｎｅの変化．基本燃料噴射量Ｔｐに基づいて．減速燃料カットを実行させる構成としても良い。

【００５９】図９は第５の実施の形態を示すエンジンのシステム図であり、前記第１～第４の実施の形態に示した補助空気量制御を、前記図９に示すシステム構成に適用することが可能である。図９において、補助空気量制御弁22下流側のバイパス通路21に、オン・オフ的に開閉駆動されるカット弁23を介装してあり．このカット弁23は．図10に示すように、ブーストセンサ18の信号をコントロールユニット10内に設けた論理回路で処理することで．該論理回路の出力に基づいて開閉（通電・非通電）制御される。即ち、ブーストセンサ18で検出されるブーストに基づいて開状態と閉状態とのいずれかに制御されるものであり．制御の信頼性を高めるためにソフトウェア処理ではなく．論理回路によって制御されるようにしてある。

【００６０】前記カット弁23は、図４に示すノーロードＮ／Ｌ相当のブースト（絶対圧）以下で、減速時の目標

ブースト以上に設定された基準ブースト以下になったときに開制御され．前記基準ブーストを超える状態では閉に制御されるようになっており、これにより、減速運転に移行した直後に開いてバイパス通路21を介した補助空気量の供給を可能ならしめるようになっている。

【００６１】かかる構成によれば、補助空気量制御弁22の開故障があっても、減速時以外で補助空気量が供給されてしまうことを回避できる。図11のフローチャートは．第６の実施の形態を示すものであり、前記図９のシステム構成に適用される補助空気量制御を示す。この図11のフローチャートにおいて、ステップ61では．触媒８の温度が減速燃料カットを禁止すべき所定の高温状態であるか否かを判別する。そして、触媒温度が高温であるときには、ステップ62へ進み、減速運転を待たずに、燃料カットが禁止される減速運転時に対応するために目標補助空気量を第１の実施の形態と同様にエンジン回転速度に応じて設定し、ステップ63では．補助空気量制御弁22の開度を前記目標補助空気量相当に開いておく。

【００６２】ステップ64では、減速燃料カット条件を判別し．条件成立時にはステップ65へ進み、触媒温度に基づいて燃料カットを禁止すべき状態であるか否かを判別する。そして．触媒温度が低く減速燃料カットを実行できるときには．ステップ66へ進んで．減速燃料カットを実行する。

【００６３】一方、触媒温度が高く減速燃料カットを禁止すべき条件であるときには、ステップ67へ進み．減速燃料カットを禁止する。このとき、カット弁23がブースト低下に伴って閉制御されるので．予め開かれていた補助空気量制御弁22で調整される補助空気量が直ちにエンジンに供給される。

【００６４】補助空気量制御弁22の開度を、減速運転に移行してから制御するのでは、開度変化の応答遅れによって目標補助空気量を直ちに得ることができないが、上記のように減速燃料カットが行われることが予測されるときに予め補助空気量制御弁22の開度を目標補助空気量に見合った開度に開いておき、実際に減速運転される前はカット弁23によって補助空気量の供給を遮断する一方．減速運転への移行と共にカット弁23を開くようにすれば．オン・オフ的に開閉されるカット弁23の応答は良いから、減速運転への移行直後から目標補助空気量を供給させることが可能である。

【００６５】尚．実際に減速運転に移行した後では、目標補助空気量を．ブーストセンサ18の検出結果や．失火の検出結果に基づいて修正し、また．該修正された目標補助空気量が所定範囲を越えるときに燃料カットへ移行させたり、加速が検出されたときに燃料カットへ移行させたりする構成とすることも可能であり、これは．後述する第７，第８の実施の形態においても同様である。

【００６６】図12のフローチャートは．第７の実施の形態を示すものであり、前記図９のシステム構成に適用される補助空気量制御を示す。この図12のフローチャートにおいて、ステップ71では．触媒８の温度が減速燃料カットを禁止すべき所定の高温状態であるか否かを判別し．触媒温度が高温であるときには．ステップ72へ進み．減速運転を待たずに．燃料カットが禁止される減速運転時に対応するために目標補助空気量を設定し．ステップ73では、補助空気量制御弁22の開度を前記目標補助空気量相当に開いておく。

【００６７】ステップ74では、スロットル弁３が全閉か否かを判別する。そして．スロットル弁３が開かれている状態であるときには、ステップ75へ進んで、ブーストセンサ18で検出されるブーストに応じたカット弁23の開閉制御に優先して、カット弁23を閉に制御する。これにより．スロットル弁３が開かれた走行状態において補助空気量制御弁22を介して補助空気量がエンジン１に供給されることを回避する。即ち、本実施の形態では．前述のように、減速運転される前に予め補助空気量制御弁22を減速時の要求に見合った開度に開けておくが．スロットル３が開かれている走行状態では．補助空気が供給されるとトルク変動が生じて運転者に違和感を与えることになってしまうので、これを確実に回避すべく．スロットル弁３が開いているときにはそのときのブーストに関わらず、カット弁23を閉じておくようにする。

【００６８】一方、スロットル弁３が全閉であるときには．ステップ76へ進み、スロットル弁３全閉以外の減速燃料カット条件を判別し．条件成立時にはステップ77へ進み．触媒温度に基づいて燃料カットを禁止すべき状態であるか否かを判別する。そして、触媒温度が低く減速燃料カットを実行できるときには、ステップ78へ進んで．減速燃料カットを実行する。

【００６９】一方、触媒温度が高く減速燃料カットを禁止すべき条件であるときには、ステップ79へ進み．減速燃料カットを禁止する。このとき、カット弁18がブースト低下に伴って閉制御される。図13のフローチャートは、第８の実施の形態を示すものであり、前記図９のシステム構成に適用される補助空気量制御を示す。

【００７０】この図13のフローチャートにおいて．ステップ81では、触媒８の温度が減速燃料カットを禁止すべき所定の高温状態であるか否かを判別し、触媒温度が高温であるときには、ステップ82へ進み．減速運転を待たずに．燃料カットが禁止される減速運転時に対応するために目標補助空気量を設定し、ステップ84では．補助空気量制御弁22の開度を前記目標補助空気量相当に開いておく。

【００７１】ステップ84では、スロットル弁３が全閉か否かを判別する。そして．スロットル弁３が開かれている状態であるときには、ステップ85へ進んで、ブーストセンサ18で検出されるブーストに応じたカット弁23の開閉制御に優先して、カット弁23を閉に制御する。一方、

スロットル弁３が全閉であるときには、ステップ86へ進み、スロットル弁３全閉以外の減速燃料カット条件を判別し、条件成立時にはステップ87へ進み、触媒温度に基づいて燃料カットを禁止すべき状態であるか否かを判別する。

【００７２】そして、触媒温度が低く減速燃料カットを実行できるときには、ステップ88へ進んで、減速燃料カットを実行する。一方、触媒温度が高く減速燃料カットを禁止すべき条件であるときには、ステップ89へ進み、補助空気量制御弁22の開度と目標開度との偏差（偏差＝実開度－目標開度）が所定範囲内である否かを判別する。

【００７３】具体的には、前記偏差が－Ｄ１よりも小さく、実開度が目標開度よりも所定値Ｄ１以上に小さいか否かを判別する。前記Ｄ１は、目標開度に対応する目標ブーストと失火限界のブーストとの偏差に相当する値であり、実開度が目標開度よりも小さくその偏差が所定値Ｄ１以上であるときには、空気量不足によって失火の可能性があるものと判断される。

【００７４】また、前記偏差がＤ２よりも大きく、実開度が目標開度よりも所定値Ｄ２以上に大きいか否かを判別する。前記Ｄ１は、目標開度に対応する目標ブーストとノーロードＮ／Ｌのブーストとの偏差に相当する値であり、実開度が目標開度よりも大きくその偏差が所定値Ｄ２以上であるときには、空気量過剰によって加速する可能性があるものと判断される。

【００７５】実開度が目標開度よりも所定値Ｄ１以上に小さいとき、又は、実開度が目標開度よりも所定値Ｄ２以上に大きいときには、減速燃料カットを禁止しても、空気量の過不足によって失火又は加速が生じる可能性があるので、ステップ88へ進み、触媒温度が高い条件ではあるが、減速燃料カットを実行させる（開度差による燃料カット強制手段）。

【００７６】一方、目標開度－所定値Ｄ１≦実開度≦目標開度＋所定値Ｄ２であるときには、失火、加速を招くような空気量の過不足を生じないので、ステップ90へ進んで減速燃料カットを禁止させる。かかる構成によると、減速燃料カット条件が成立する直前に触媒温度が高いと判断され、補助空気量制御弁22の開度を予め目標補助空気量に見合った開度に制御しようとしたが、減速運転に入る前までに目標開度にまで制御させることができず、然も、そのときの目標開度と実開度との偏差が失火、加速を招く程度の比較的大きい値であるときには、減速燃料カットを禁止しても初期状態において失火、加速の可能性があるため、減速燃料カットをそのまま実行させ、失火、加速の発生を未然に防止する。

【００７７】尚、本発明は、開度が電気的に制御されるスロットル弁を備え、これをバイパスする通路を持たないエンジンにも適用可能である。即ち、このようなエンジンにおいても、エンジンの出力が要求されない状況

（例えば、運転者によるアクセル踏み込み量が０の状態）ではスロットル弁開度が略全閉に制御され、このときのエンジン回転速度が所定回転速度以上であれば燃料カットを行うのであるが、この際、燃料カット条件と触媒温度による燃料カット禁止条件とが共に成立した場合には、エンジン回転速度に応じて設定される微小開度だけスロットル弁開度を増大補正すれば良い。

【図面の簡単な説明】

【図１】請求項３記載の発明の構成を示すブロック図。

【図２】第１の実施の形態におけるエンジンのシステム構成図。

【図３】第１の実施の形態における補助空気量制御の内容を示すフローチャート。

【図４】ノーロード相当のブースト及び失火限界ブーストと目標ブーストとの相関を示す図。

【図５】第２の実施の形態におけるエンジンのシステム構成図。

【図６】第２の実施の形態における補助空気量制御の内容を示すフローチャート。

【図７】第３の実施の形態における補助空気量制御の内容を示すフローチャート。

【図８】第４の実施の形態における補助空気量制御の内容を示すフローチャート。

【図９】第５の実施の形態を示すエンジンのシステム構成図。

【図10】第５の実施の形態におけるカット弁の駆動回路を示す図。

【図11】第６の実施の形態における補助空気量制御の内容を示すフローチャート。

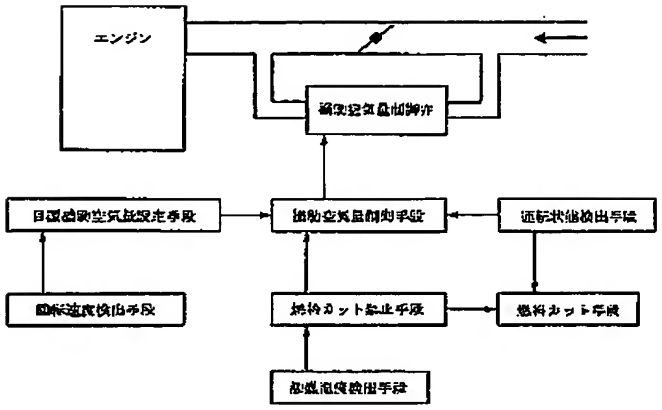
【図12】第７の実施の形態における補助空気量制御の内容を示すフローチャート。

【図13】第８の実施の形態における補助空気量制御の内容を示すフローチャート。

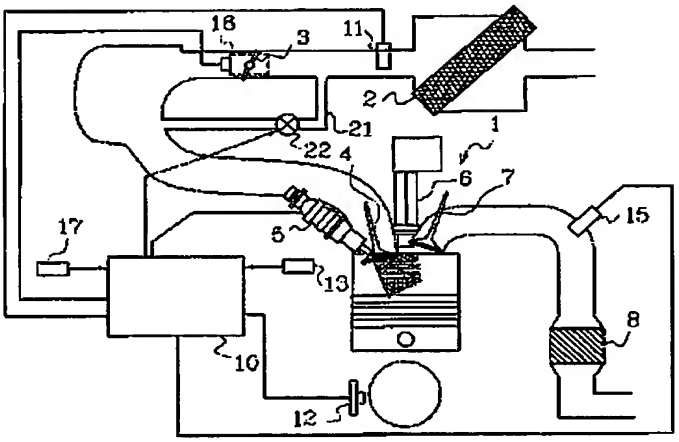
【符号の説明】

1	エンジン
3	スロットル弁
5	燃料噴射弁
8	触媒
10	コントロールユニット
11	エアフローメータ
12	ポジションセンサ
13	リファレンスセンサ
15	空燃比センサ
16	スロットルセンサ
17	水温センサ
18	ブーストセンサ
21	バイパス通路
22	補助空気量制御弁
23	カット弁

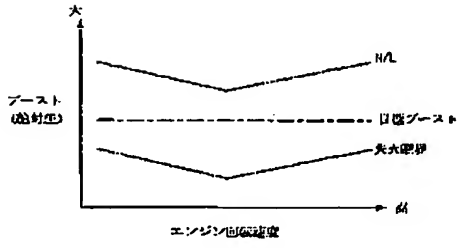
【図１】


エンジン
目標過剰空気係数設定手段
燃焼空気量制御手段
運転状態検出手段
回転速度検出手段
燃料カット禁止手段
燃料カット手段
触媒温度検出手段

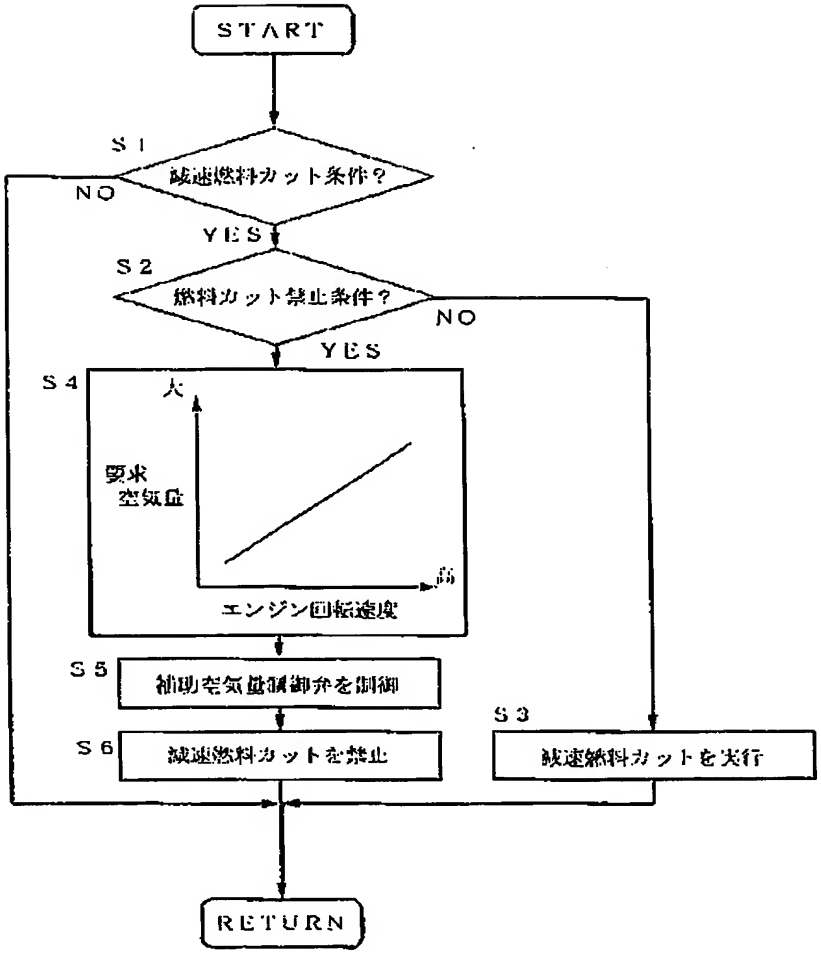
【図２】


16
3
11
2
21
22
4
1
6
7
15
17
5
13
8
10
12

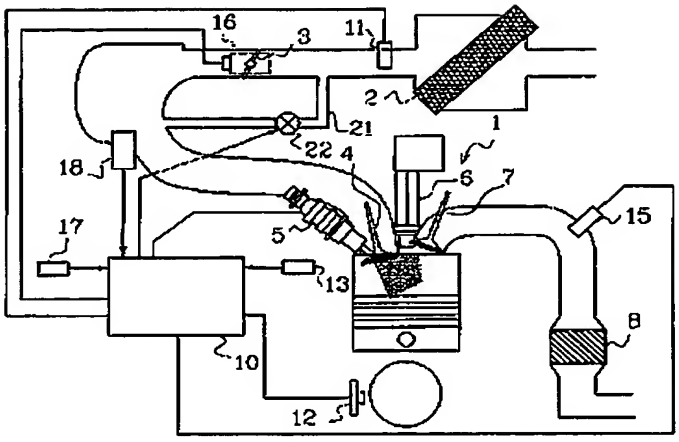
【図４】


大
NA
ブースト
(絶対圧)
目標ブースト
最大限界
小
エンジン回転速度

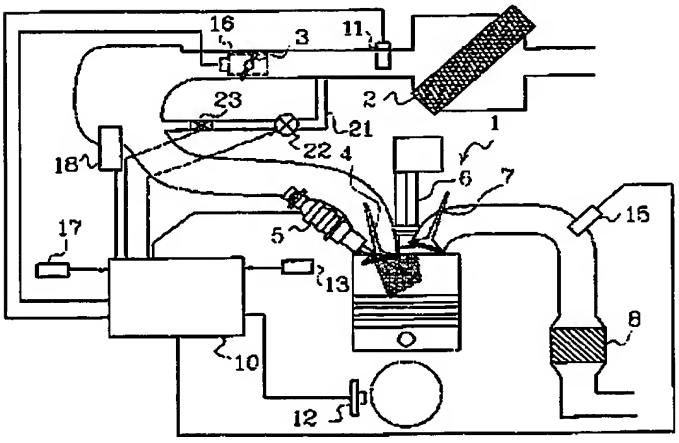
【図3】


START
S1
減速燃料カット条件？
NO
YES
S2
燃料カット禁止条件？
NO
YES
S4
大
要求
空気量
高
エンジン回転速度
S5
補助空気量制御弁を制御
S6
減速燃料カットを禁止
S3
減速燃料カットを実行
RETURN

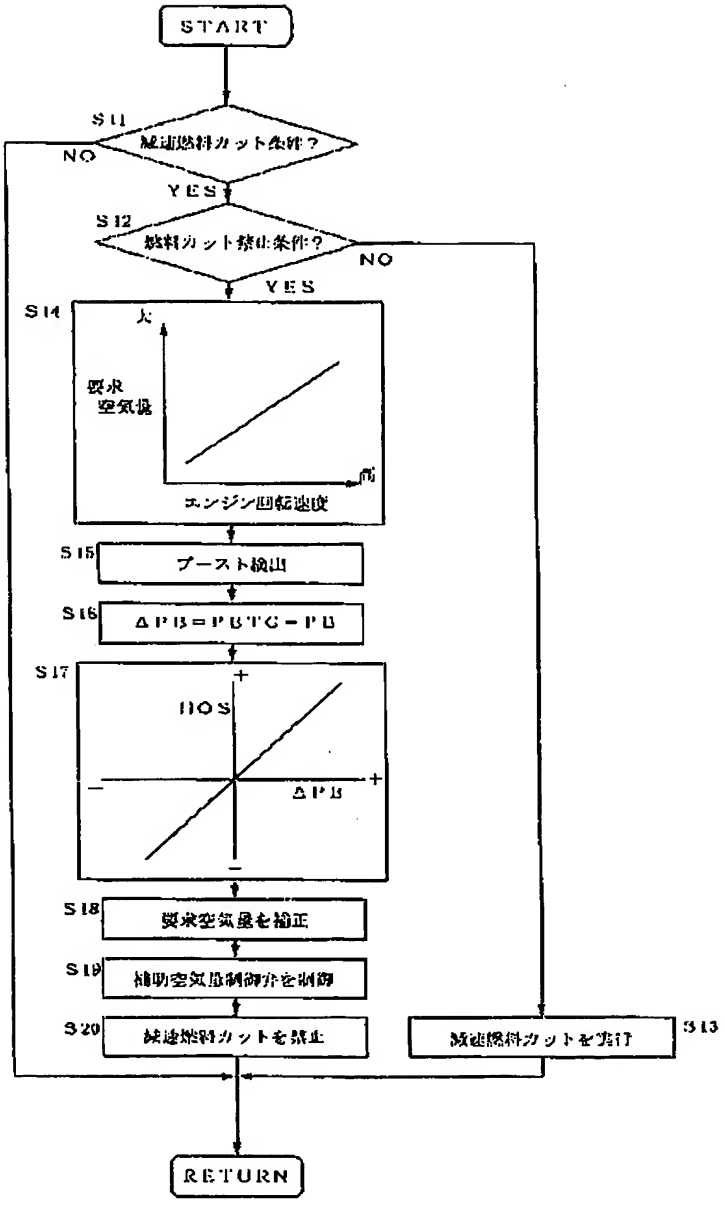
【図5】


16
3
11
2
21
22
4
1
18
6
7
15
17
5
13
8
10
12

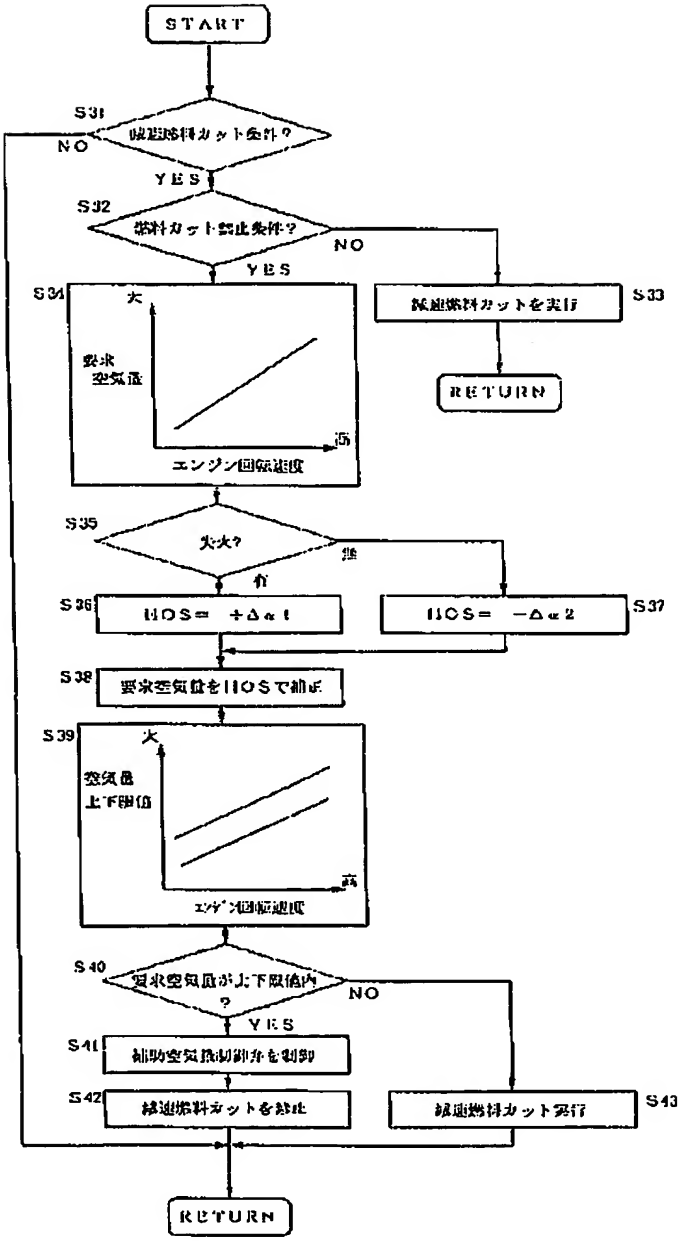
【図9】


16
3
11
23
2
21
1
22
4
18
6
7
15
17
5
13
8
10
12

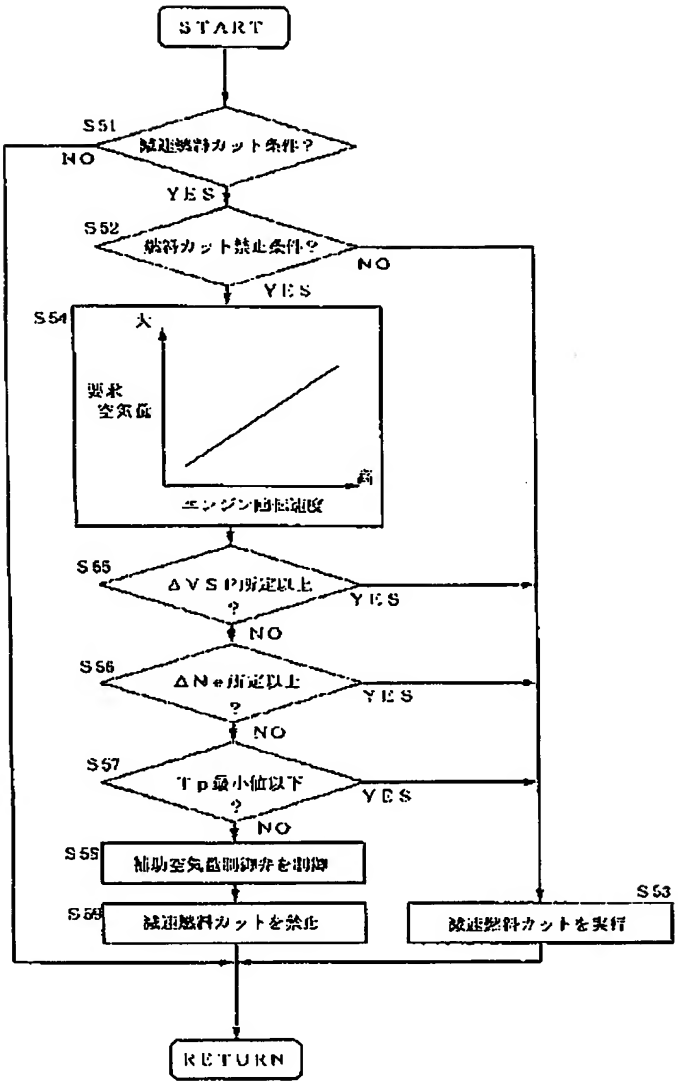
【図6】


START
S11
減速燃料カット条件？
NO
YES
S12
燃料カット禁止条件？
NO
YES
S14
大
要求空気量
エンジン回転速度
S15
ブースト検出
S16
ΔPB=PBTG−PB
S17
+
HOS
−
+
ΔPB
−
S18
要求空気量を補正
S19
補助空気量制御弁を制御
S20
減速燃料カットを禁止
減速燃料カットを実行
S13
RETURN

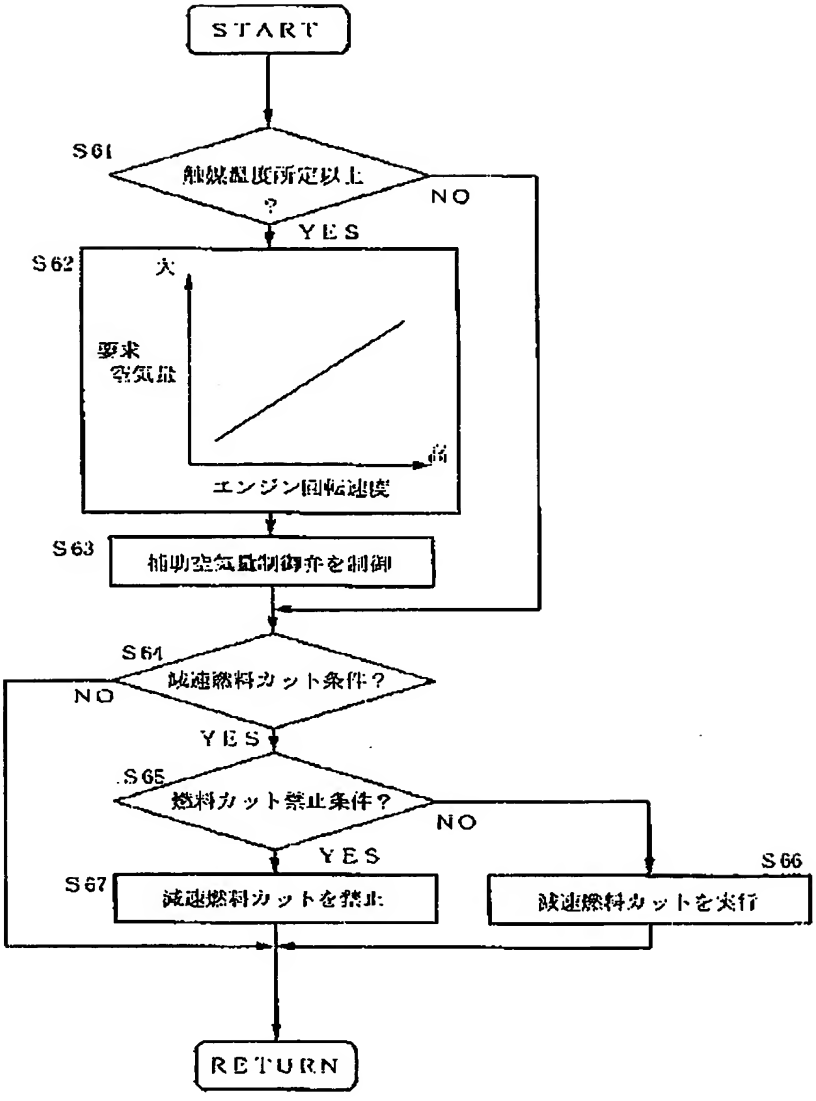
【図7】


START
S31
減速燃料カット条件?
NO
YES
S32
燃料カット禁止条件?
NO
YES
S34
大
要求空気量
小
エンジン回転速度
S33
減速燃料カットを実行
RETURN
S35
大火?
YES
NO
S36
HOS= +Δα1
S37
HOS= −Δα2
S38
要求空気量をHOSで補正
S39
大
空気量上下限値
小
エンジン回転速度
S40
要求空気量が上下限値内?
NO
YES
S41
補助空気制御弁を制御
S42
減速燃料カットを禁止
S43
減速燃料カット実行
RETURN

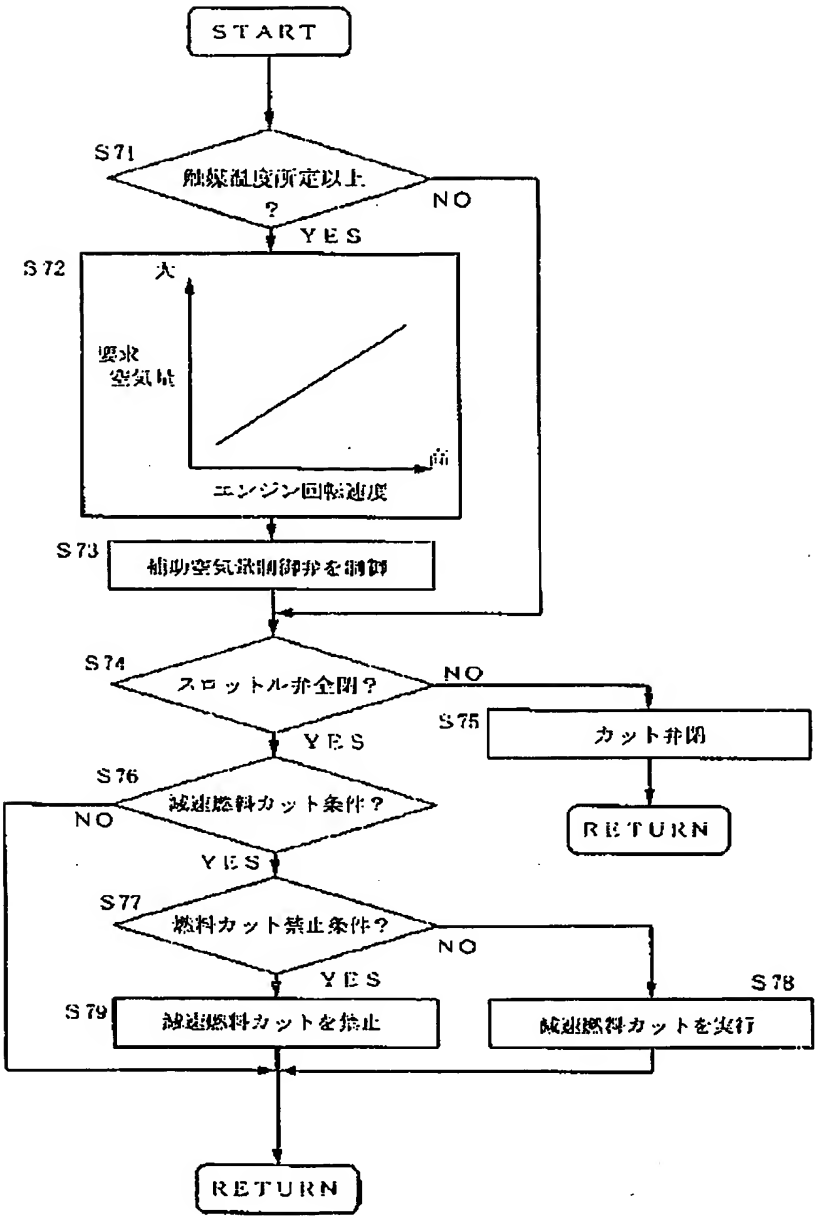
【図8】


START
S51
減速燃料カット条件？
NO
YES
S52
燃料カット禁止条件？
NO
YES
S54
大
要求空気量
高
エンジン回転速度
S65
ΔVSP所定以上？
YES
NO
S56
ΔNe所定以上？
YES
NO
S57
Tp最小値以下？
YES
NO
S55
補助空気量制御弁を制御
S58
減速燃料カットを禁止
S53
減速燃料カットを実行
RETURN

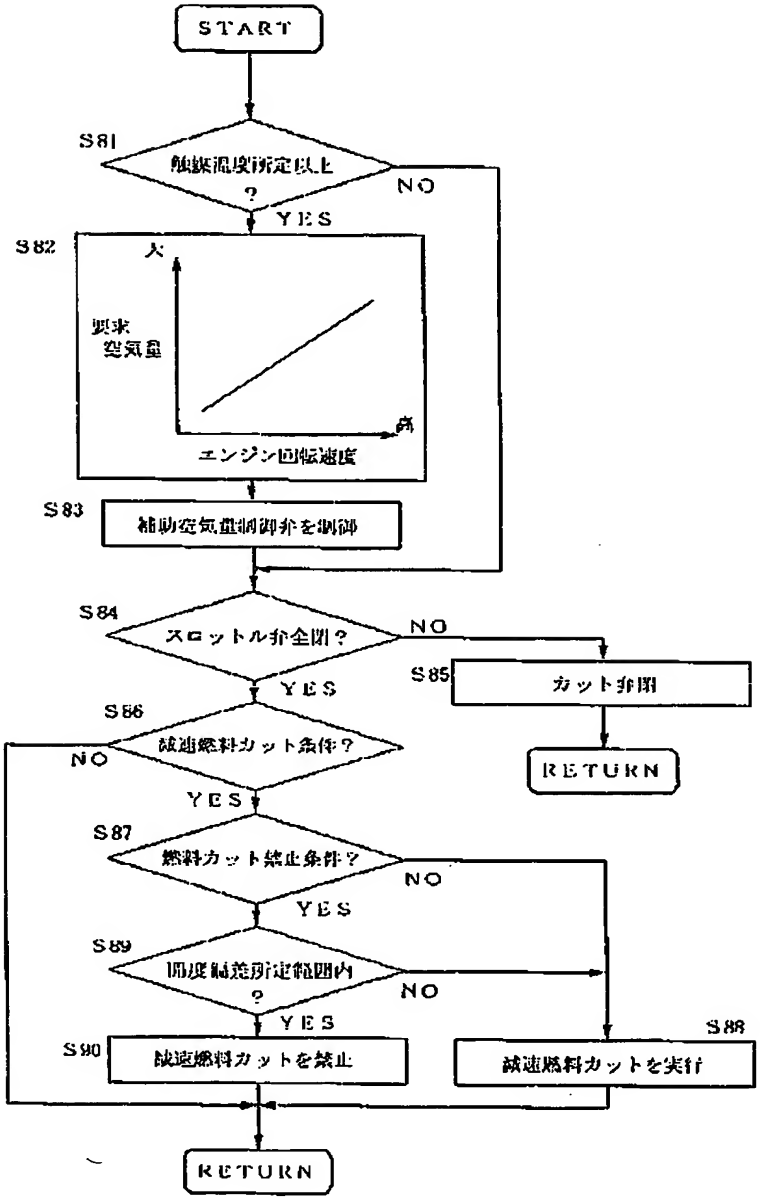
【図11】


START
S61
触媒温度所定以上？
NO
YES
S62
大
要求空気量
高
エンジン回転速度
S63
補助空気量制御弁を制御
S64
減速燃料カット条件？
NO
YES
S65
燃料カット禁止条件？
NO
YES
S66
減速燃料カットを実行
S67
減速燃料カットを禁止
RETURN

【図１２】


START
S71
触媒温度所定以上？
NO
YES
S72
大
要求空気量
高
エンジン回転速度
S73
補助空気量制御弁を制御
S74
スロットル弁全閉？
NO
YES
S75
カット弁閉
RETURN
S76
減速燃料カット条件？
NO
YES
S77
燃料カット禁止条件？
NO
YES
S78
減速燃料カットを実行
S79
減速燃料カットを禁止
RETURN

【図13】


START
S81
触媒温度所定以上
？
NO
YES
S82
大
要求
空気量
小
エンジン回転速度
S83
補助空気量制御弁を制御
S84
スロットル弁全閉？
NO
YES
S85
カット弁閉
RETURN
S86
減速燃料カット条件？
NO
YES
S87
燃料カット禁止条件？
NO
YES
S89
回度偏差所定範囲内
？
NO
YES
S88
減速燃料カットを実行
S90
減速燃料カットを禁止
RETURN